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# The Heating and Ventilating Magazine

*A Monthly Journal of Engineering Progress*

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FEBRUARY, 1927

Published monthly by
Heating & Ventilating Magazine Co.
1123 Broadway, New York

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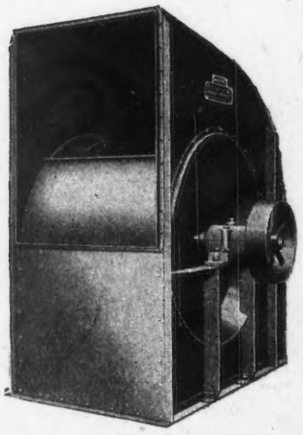

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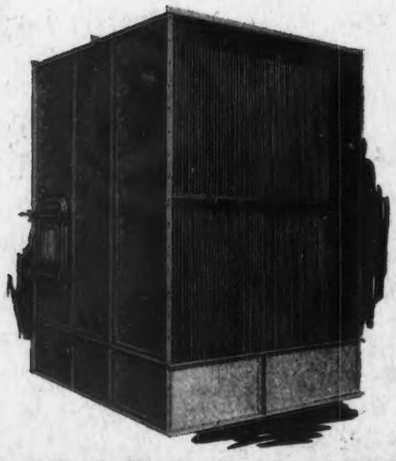

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VOL. XXIV Reg. U. S. Pat. Off. Reg. Canadian Pat. and Copr't Off. No. 2

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# The Decided Success of The DUAL THERMOSTAT

*Applies To ALL Classes Of Buildings.*

IN school buildings, for instance, where night classes are conducted: At the close of the day sessions, between three and four o'clock in the afternoon, the school principal or janitor - operating a switch in his office - can turn down the heat in all of the rooms not to be used at night, and leave on the heat only in the rooms that are to be used. The next morning by operating the same switch he turns the heat on in ALL of the rooms for the day. Thus fuel is consumed at night only for the rooms used, instead of for the entire building. And thus the school's peak fuel consumption is topped as soon as final day classes are dismissed: between three and four o'clock in the afternoon.

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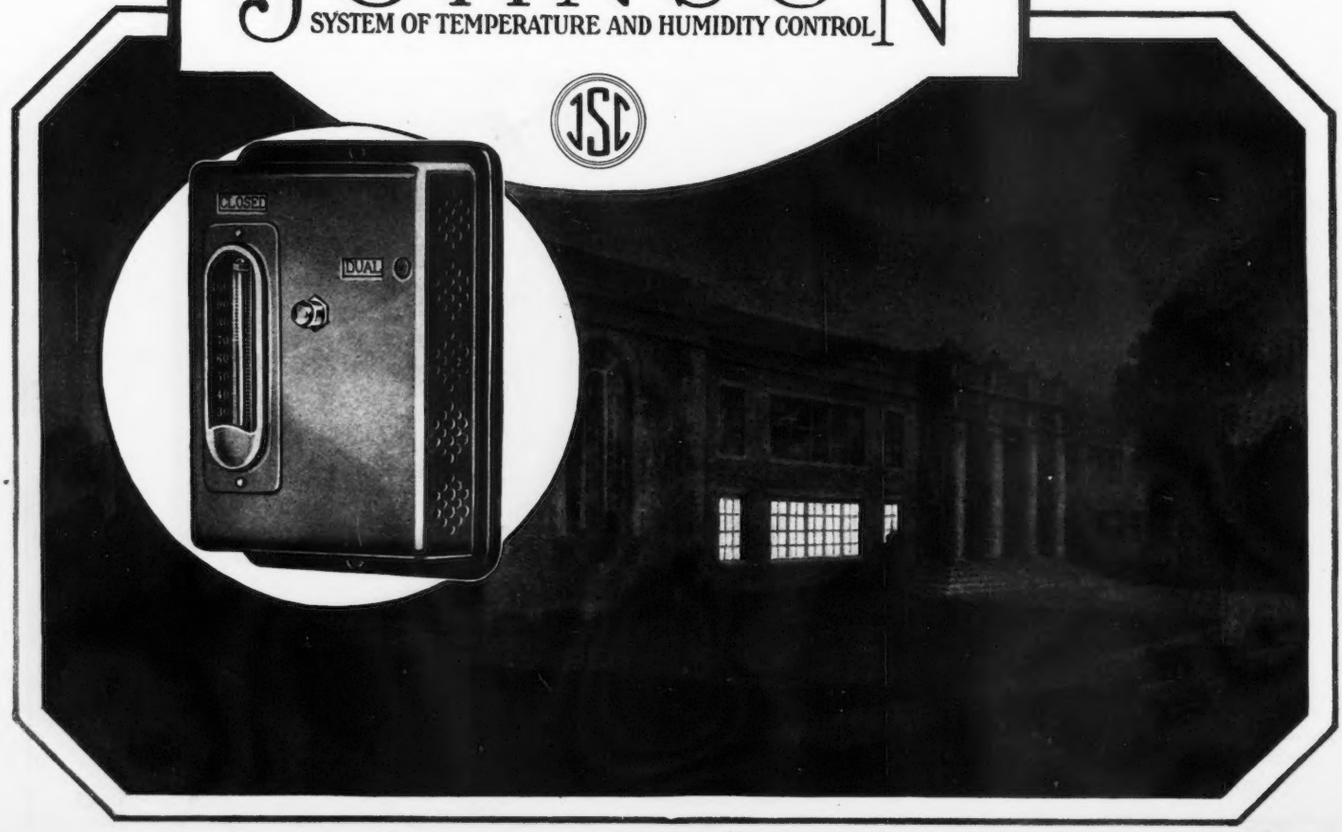
*And Innumerable others East, West, North and South.*



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*A Monthly Journal of Engineering Progress*

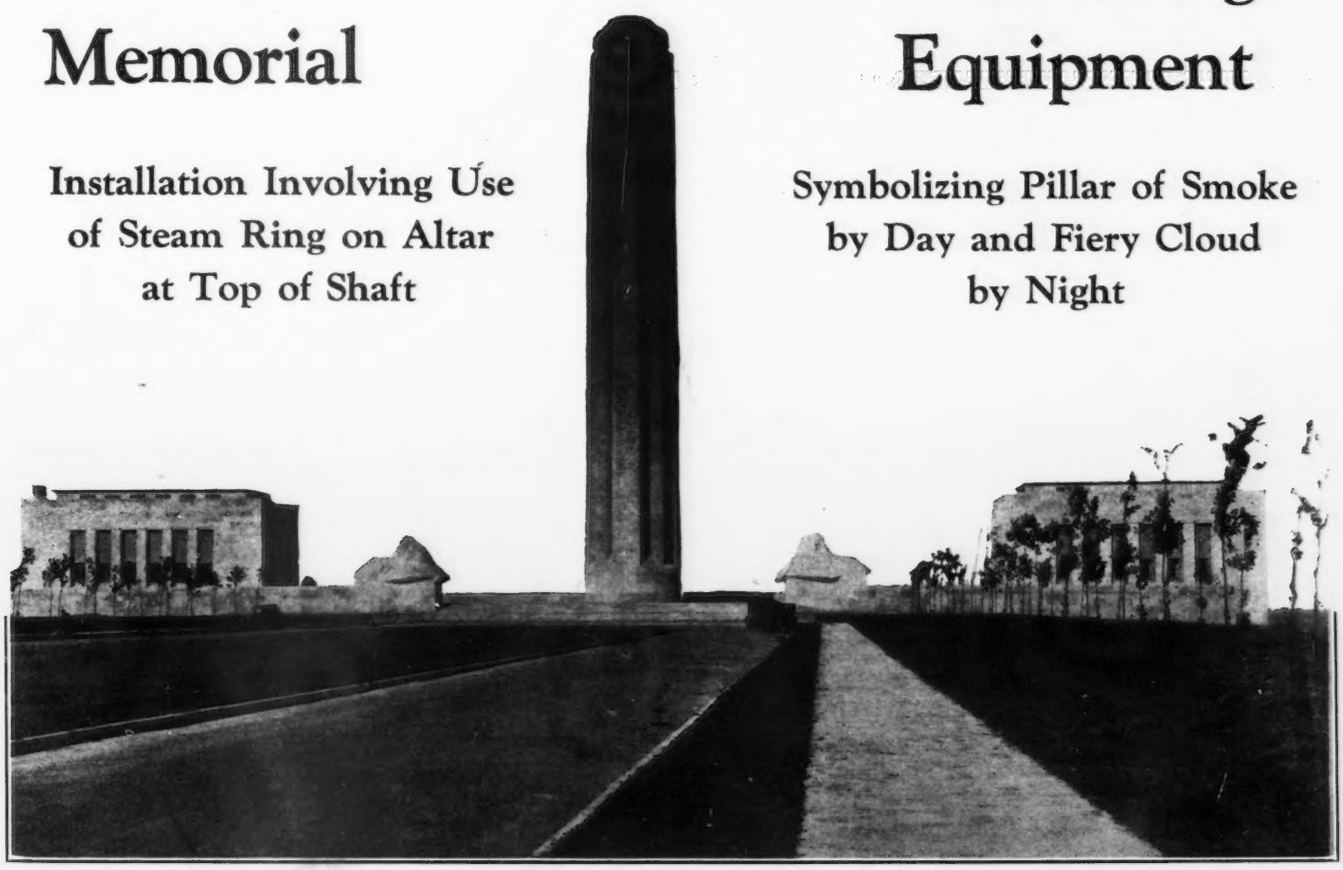
FEBRUARY, 1927

# Kansas City Liberty Memorial

## Installation Involving Use of Steam Ring on Altar at Top of Shaft

# Heating and Ventilating Equipment

## Symbolizing Pillar of Smoke by Day and Fiery Cloud by Night



H. Van Buren Magonigle, Architect — **Kansas City Liberty Memorial** — Clark, MacMullen and Riley, Engineers.

A MEMORIAL to those who died in the World War, a recognition of those who survived, and an inspiration to future generations—this briefly explains the purpose of the Liberty Memorial erected in Kansas City, Mo., from funds secured entirely through popular subscription. The principal inscription on the Memorial, on the south side, reads:

"In honor of those who served in the World War in the defence of liberty and our country."

This inscription was dedicated in 1921.

At the laying of the corner stone, which took

place Armistice Day, 1924, an inscription was placed on this stone, as follows:

"Dedicated Nov. 1, 1921 in the presence of
Marshal Foch
Admiral Beatty
General Pershing
General Diaz
General Jacques
Vice-President Coolidge
Robert A. Long, President
of the Liberty Memorial Association.
Guests of the American Legion."

In arrangement, the Memorial consists of a towering shaft in the middle, flanked, on either side by two buildings; one of these buildings is known as Memory Hall, being given over to memorial purposes, while the other is used for patriotic preservations, being called the Museum Building.

### NOVEL TREATMENT OF SHAFT

The central shaft is 36 ft. in diameter at the base and rises as a sheer and almost uninterrupted column for a height of 216 ft., or about 21 stories. On the top of this shaft is an altar of eternal fire, from the bowl of which arises a pillar of smoke by day and a fiery cloud by night. Around the bowl and supporting it are four guardian spirits.

The Memorial stands not so much as a symbol of War as an inspiration of peace, the guardian spirits representing Courage, Honor, Patriotism and Sacrifice. They guard an altar on which an everlasting flame is forever to burn high in the skies.

A whole article well could be written on the artistic and architectural features of this imposing pile; artists from all over the country have contributed their quota. The whole development represents the working out of a comprehensive plan in painstaking detail, item by item.

It is now necessary, however, to leave the sublime and descend to the more practical and utilitarian. Here is a case where the heating industry really *"capped the climax"* and it came about in this manner.

### STEAM BOILER AND RING USED TO REPRESENT ALTAR FIRE

When ways and means came to be considered as to how to reproduce a representation of an undying fire in a realistic manner on the altar at the top of the shaft, several ideas were proposed and discarded. Finally, the representation of smoke by means of steam was considered and, at length, adopted. Illumination of this smoke-symbol at night by means of colored flood lights and reflectors, making it into a fire cloud, answered the question of how to render the representation a night, as well as a day, spectacle.

Thus the ever-enduring fire on the top of this two-million-dollar monument is really supplied by an ordinary oil-fired, steam-heating boiler as later described. For this reason the heating equipment installed in the Memorial is of more than usual interest.

The two buildings are heated by a two-pipe vapor-steam system, with supply and return mains for the

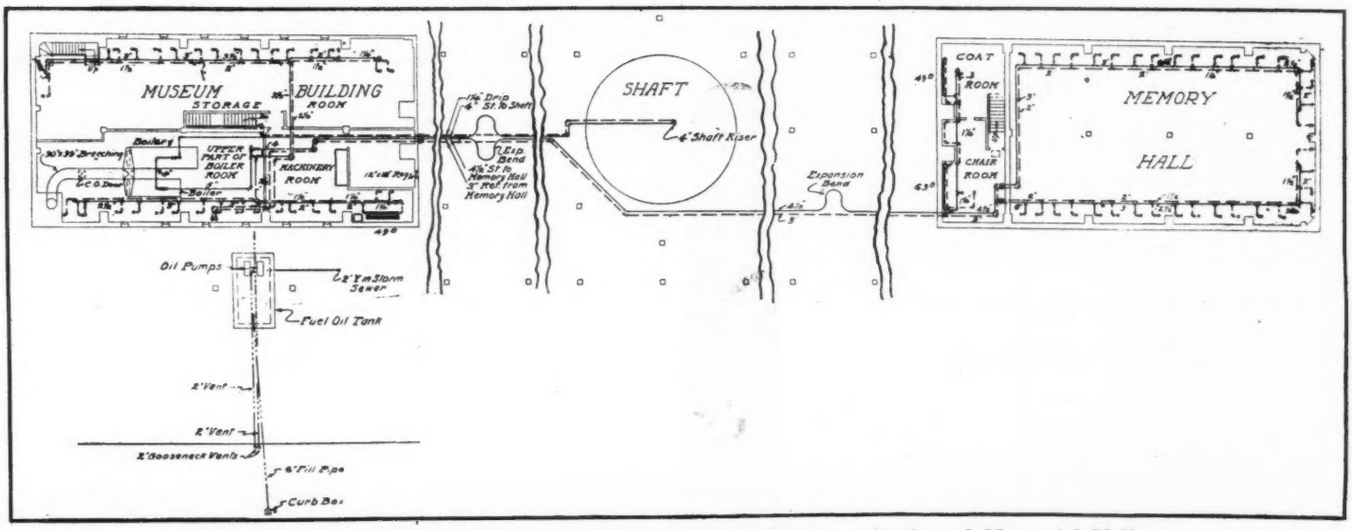



**Fig. 1. General Plan of Basement Showing Steam Mains to Shaft and Memorial Hall**

most part under the first floor of each building. Between the two buildings the mains are suspended from the memorial court construction. A vacuum pump is installed in the boiler room and is so connected with the return piping as to permit the condensation from both buildings to be pumped back to either boiler or to allow it to flow back by gravity. A plan showing the basement piping is given in Fig. 1.

### PIPING

Standard, full-weight steel and wrought-iron piping is used in the heating system with standard weight, cast-iron, screwed pipe-fittings, the reducing fittings on the steam and return main being made eccentric. Valves 2-in. and less are solid brass while, above this size, cast-iron bodies with brass trimmings are used.

Steam-supply piping is arranged with a 4-in. line carried from the large boiler over to the shaft and up the shaft to the top of the building where it is

connected to the 4-in. steam ring through two 3-in. connections. (See Fig. 2.)

The main 4-in. riser has a 4-in. flanged tee at the base and a drip-pocket extending 24-in. below this tee and terminating in a second flanged tee which is dripped. This main steam-riser is guided every 30-ft. in its rise up through the shaft and at the top has a firmly anchored Ross slip-expansion joint.

A Crane tilt-trap is used on the drip line from the main riser and is arranged to return the condensation to the boiler even when under pressure.

### A NOVEL STEAM RING

Where "steam ring" is mentioned it refers to a circular loop about 9 ft. diameter of 4-in. brass pipe, with two 3-in. brass, flanged connections for steam entrance into the ring. This ring has all joints brazed and has 60 evenly-spaced holes, drilled and tapped for ¾-in. pipe connection. In each hole is screwed a ¾ x ½-in. brass bushing. The steam issuing from the ½-in. openings in this ring produces the appearance of smoke rising from the altar. (See detail of ring, Fig. 3.)

On the horizontal run three expansion pipe-bends are used, having flanged couplings.

### RADIATION

In the Museum proper and in the Memory Hall building all radiators are concealed by enclosures; elswhere all radiation and coils are exposed. (See plan of Memory Building, Fig. 4.)

Plain-pattern, column-and-wall type radiators are used throughout. Tappings used for radiator connections are top-and-bottom, opposite ends, with eccentric bushings used on the return ends. All radiation is cast-iron, hot-water type and, where wall radiators are used, they are supported on concealed wall hangers.

### RADIATOR VALVES

A scheme of making radiator valves one size smaller than the runout was adopted on this building. The radiator traps were required to have a capacity of not less than 100 sq. ft. of equivalent direct radiation unless specially marked otherwise.

Radiators which are not equipped with thermostatic control have the supply ends provided with Webster radiator valves and on the return ends are placed thermostatic traps of Webster make. Similar traps are placed on all drip connections from the steam main and an alternating-receiver is installed on the main return line to eliminate air, as well as to return the condensation to the boiler under pressure.

### RADIATOR PIPING

Radiator turnouts are arranged to grade back toward the riser or main, and the sizing schedule, where not specially marked otherwise, is as follows:

| Size of Radiator Sq. Ft. | Supply In. Diam. | Return In. Diam. |
|---|---|---|
| Up to 20 | ¾ | ¾ |
| 21 to 50 | 1 | ¾ |
| 51 to 80 | 1¼ | 1 |
| 81 and over | 1½ | 1 |

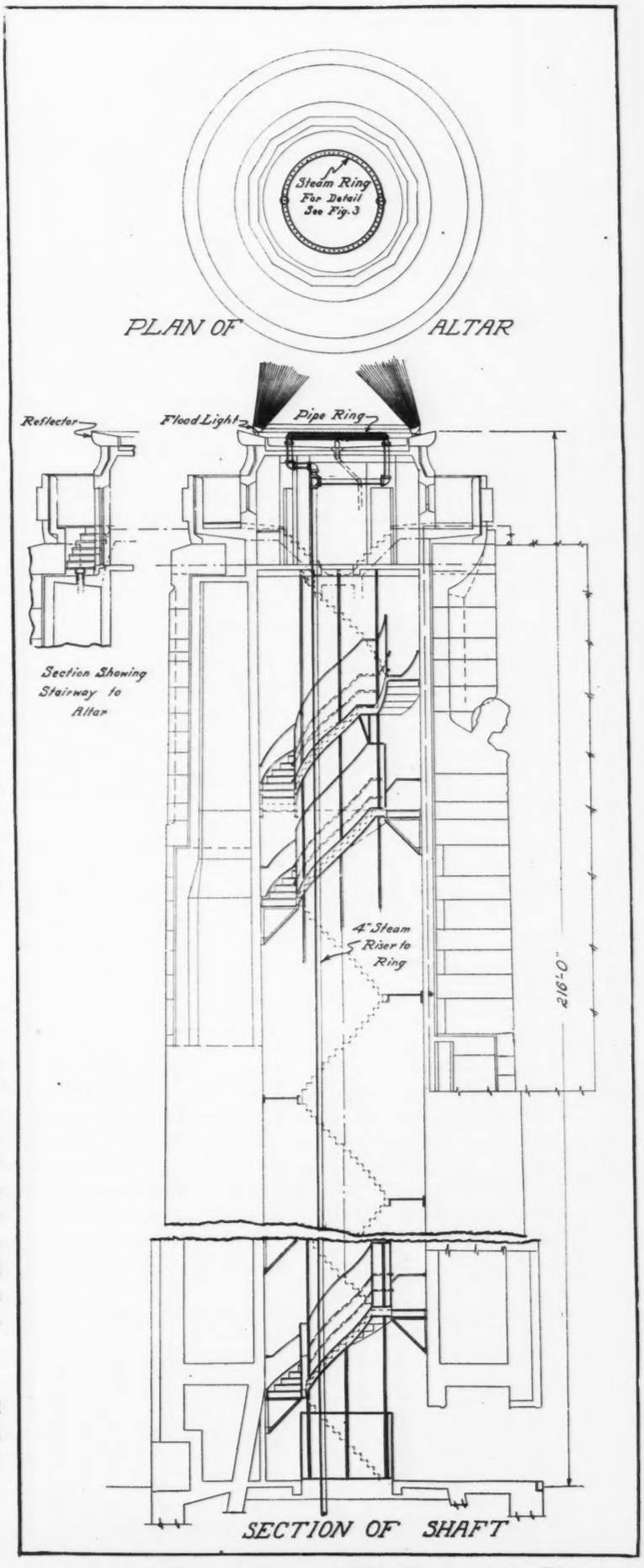



**Fig. 2. Plan and Section of Shaft Showing Steam Ring and Steam Supply**

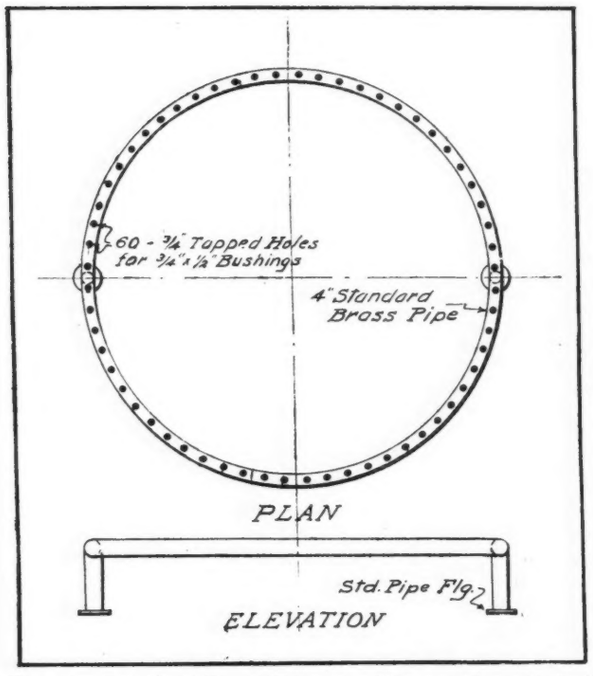



**Fig. 3. Detail of Steam Ring on Altar at Top of Shaft**

THERMOSTATIC CONTROL

A Johnson system of automatic temperature control was installed for all concealed radiators in both the Museum and Memory Hall buildings. Thermostats are mounted on ½-in. thick asbestos boards.

The diaphragm radiator valves are of the metal-bellows type and the thermostats are arranged for key adjustment only.

In the boiler room is located an electric-driven air compresser, with an air-storage tank, automatic control, pressure gauges and pressure-reducing valve. The air piping run between the two buildings is carried close to the return line so as to be enclosed when the hair-felt covering is applied to the return.

VACUUM-RETURN PUMP

A combination vacuum-and-return pump is also provided, consisting of a Nash vacuum-and-boiler-feed pump with both pumps mounted on one shaft and driven by a direct-connected ¾-H. P., motor wound for 3-phase, 60-cycle, 220-volt alternating current. The piping is so arranged for this combination pump as to permit the pump to be used to remove the air from the system and to discharge the condensation to either boiler or to permit the system to operate by gravity, with the use of the alternating receiver by by-passing the pump altogether.

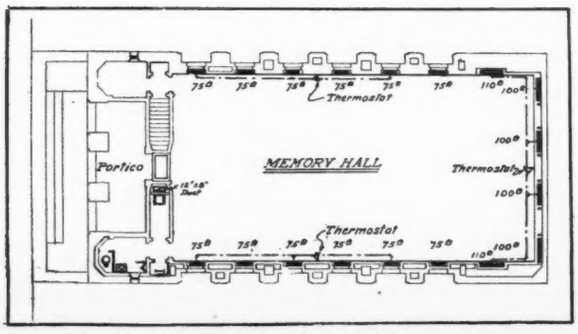



**Fig. 4. Plan of Heating in Memory Hall**

PIPE COVERING

Piping in the basement floors of both buildings and the supply and return lines to the pipe coils in the roof space of the Museum Building, is covered with 1-in. asbestos, air-cell, sectional pipe-covering, banded, and with the fittings covered with plastic cement and hard plaster finish to match.

All other piping carrying steam or condensation (including the runs between the Museum and Memory Hall buildings, the horizontal and vertical lines connecting to the steam ring at the top of the shaft, the drip line, as well as the distributing and return mains under the first floor of the Legion building), is covered with standard thickness of 85% magnesia sectional-covering and 1-in. thickness of hair felt over this. Outside of the hair felt is placed a wrapping of Rubberoid roofing paper, lapped 3 in. and wired on with copper wire.

BOILERS

Two boilers are installed, one for heating service and one for supplying the steam ring at the top of the shaft. The heating boiler is a Kewanee No. 311,

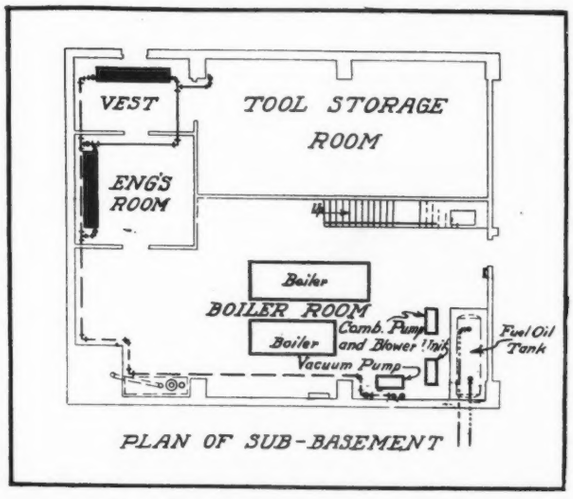



**Fig. 5. Plan Showing Arrangement of Boiler Room**

with a heating surface of 505 sq. ft., while the boiler supplying the ring is a Kewanee No. 316, with a heating surface of 773 sq. ft. Both boilers are of the firebox, smokeless, return-tubular type, with the grates omitted so as to permit the use of oil burners.

Steam piping is so arranged that either boiler may be used to supply the heating system. (For a plan and elevation of the boiler room, see Figs. 5 and 6.)

SMOKE BREECHING

Smoke breeching, connecting the smoke outlets of the two boilers to the chimney, is constructed of No. 16 U. S. gauge, soft, block steel and is equipped with a large main damper, with lever and quadrant on the outside of the breeching so that the main damper can be locked in permanent position. Each of

the boiler uptakes is provided with a positive shut-off damper opened from the floor by means of a handwheel, rod, and worm gear.

### BOILER AND OIL PIPE COVERING

Covering used on the two boilers is 1½-in. 85% magnesia blocks with ½-in. hard plaster finish. Breeching and boiler smoke-connections are covered with 1-in. asbestos, air-cell sheets, with ½-in. hard plaster finish. Piping in the boiler room and sub-basement of the Museum Building (including all pipes carrying oil between the oil-storage tanks and the oil burners, as well as the steam line from the boilers to the oil-storage tank), is covered with standard 85% magnesia, sectional pipe-covering. Fittings are covered with plastic cement, with hard plaster finish of same thickness as the pipe-covering.

### OIL-BURNING EQUIPMENT

Fuel-oil-burning equipment consists of a complete outfit of burners, oil-storage tank, auxiliary tank, oil-lifting pump, combination oil-pump-and-blower units, regulators and oil piping. The oil storage tank

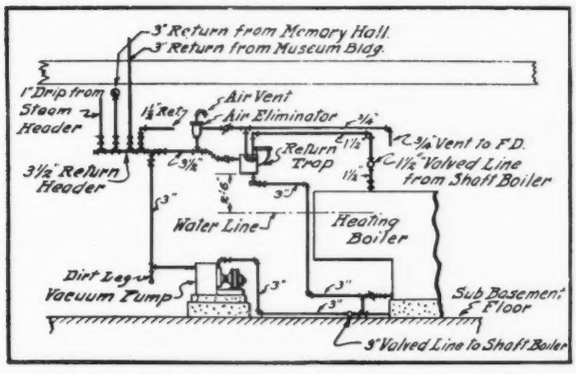



**Fig. 6. Detail of Return Connections to Boiler**

is located outside the Museum building and below grade level, with two oil pumps to lift the oil from the storage tank to the auxiliary tank set on the boiler-room floor. Combination oil-pump-and blower units are set at the rear of the boilers. (See Fig. 7 for detail of boiler setting to accommodate oil-burners.)

### OIL-STORAGE TANKS

The main oil-storage tank has a capacity of 6,000 gal. and is 8 ft. diameter by 16 ft. long, being constructed of ¼-in. thick tank-steel plate. The auxiliary tank is of 500 gal. capacity, 3 ft. in diameter by 10 ft. long and is built of 3/16-in. thick metal. Both tanks have dished heads, and the auxiliary tank is provided with an oil gauge and an overflow leading back to the main oil-storage tank.

### OIL PIPING

A main fill-pipe of 6-in. size is connected to the oil-storage tank, this fill-pipe having a liquid seal inside of the tank and terminating at grade on the south side of the Museum Building where it is

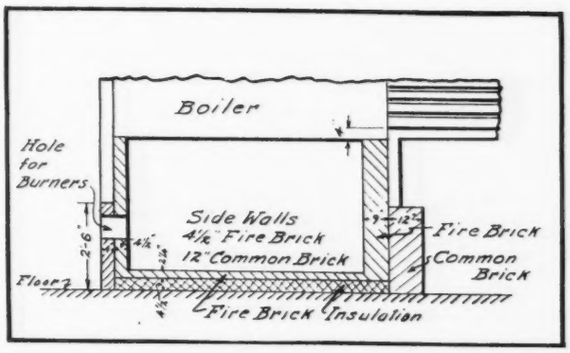



**Fig. 7. Arrangement of Boiler Setting for Oil Burner**

provided with a water-tight cap and curb box. The oil-storage tank is vented by a 2-in. vent pipe run to a point outside the building and finished off with a goose-neck, protected by a 30 x 30-mesh Monel-metal screen.

Similar venting is provided on the auxiliary oil tank, this vent pipe being carried up through the roof.

### OIL BURNERS

Under each boiler are placed two Fess oil burners, of turbine type. Two spare burners are also furnished for use in case of emergency.

### OIL HEATERS

An oil heater is also installed, having a capacity for raising the temperature of the oil required for the boilers to 160°F. The required heat is supplied by valved hot-water connections run from each boiler. This is accomplished by locating the heater below the level of the boiler water-line.

On the oil heater 1-in. moulded blocks of 85% magnesia are used, covered with plastic cement with a hard plaster finish.

### OIL PIPING

A compressed-air line, with a reducing valve, is also run from the air-storage tank of the temperature-control system to, and is connected with, the oil-indicator system. The indicator system is so designed that it is possible to determine the level of oil in either tank independently. The indicator may

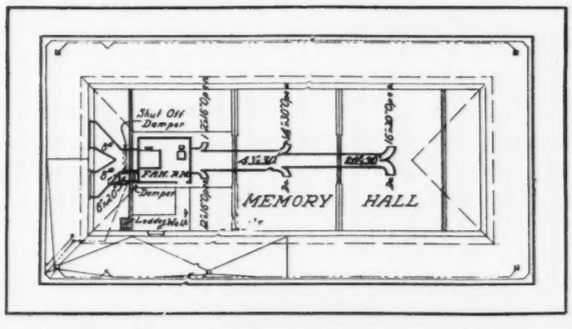



**Fig. 8. Plan of Exhaust System in Roof Space of Memory Hall**

*(Continued on Page 71)*

# Design of a Small Community Heating Plant

## Working Out the Calculations and Details for a Central Plant and Distributing Mains

*By Harold L. Alt*

As the small community heating plant undoubtedly is going to be the answer to the house heating problem in a great many cases, it is desirable to consider the conditions under which such a plant would be most suitable. In order to do this intelligently it is necessary to consider the design in detail. Such a plant in an unsuitable locality, so that its service is unsatisfactory, means a loss in investment, in reputation, and will cause a heartache for some one.

On the other hand, a well-designed plant in a

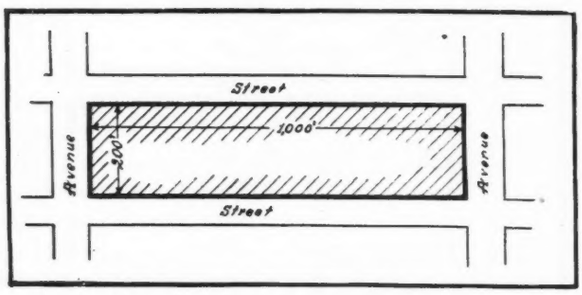



**Fig. 1. Typical City Block**

proper locality is a boon to the community, a true economy and a monument to the man or men with the brains and initiative to conceive and execute such a farsighted installation.

### LIMITATIONS OF COMMUNITY PLANTS

The community plant which stands the best chance of becoming a reality is one which doesn't become involved in franchises and politics at the start,—factors quite likely to prove the Waterloo of more worthy and important projects than community heating. To avoid these difficulties the plant should be arranged so that its mains need not cross any streets, for this leads into franchises and conflicts with public service corporations who fear their future rights are likely to be jeopardized. This does not mean a great deal as it is only necessary to confine the operation of the plant to the city block which it serves. At first thought it would seem that this is a most serious limitation, but, as a matter of fact, it is nothing of the kind.

### A TYPICAL PROPOSITION

Fig. 1 illustrates a typical city block. While every city block is differently divided up, as far as lots and houses are concerned, it is quite likely that 40 to 80 houses will be included in this area. Of course, there are larger blocks and smaller ones but the block shown is a fair example of what may be encountered. This block is approximately 1,000

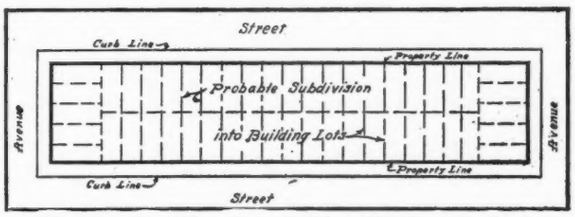



**Fig. 2. Subdivision of City Block into Lots**

ft. long and 200 ft. wide. The average lot is, say, 40 ft. x 100 ft. and has 4,000 sq. ft. There are, consequently, in this typical block, about 50 lots.

In a sparsely built-up district all these lots may not have houses, but in the matter of a short time they undoubtedly will. Where building has been fairly well carried out, most of the lots will have houses. Possibly a block or two of stores, with apartments above, will be included or may be a later development. Fig. 2 shows the conventional dividing-up of such a block into lots such as might exist in the typical example chosen.

### ALLOWANCES FOR FUTURE LOADS

Where the houses are in actual existence it is possible to get definite data on the heating requirements, while future construction must be estimated as nearly as practicable and provision made for

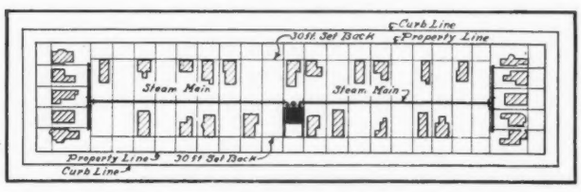



**Fig. 3. Examples of Steam Main Running through City Block**

the future supply of such buildings as may desire to use the community plant.

The usual amount of load to allow for moderate-sized residences is about 300 sq. ft. of direct steam radiation or its equivalent; for large residences 500 to 700 sq. ft., and, for bungalows and very small houses, 150 to 250 sq. ft. For shops with apartments above them about 500 sq. ft. per lot should be ample.

### LOCATION OF PLANT

The next matter to be considered is the location of the plant. To avoid long runs of mains and to

keep down the sizes of pipe, as well as the cost of materials, the preferable location is near the center of the block; that is, near the middle of the long side of the block. The plant may be located on either of the long sides of the block with equal facility, local conditions such as property available, etc., usually determining this point.

### RETURNING THE CONDENSATION

To get the probable load on the boilers it is now necessary to determine the total house-heating loads and the size of steam mains; also to decide if the condensation is to be returned to the boilers or is to be drained from each residence.

When the condensation is returned, the advantage is secured of having warm water to feed into the boilers, instead of cold water, giving a greater production of steam per pound of coal burned. Difficulties are also encountered in some localities when it is tried to discharge hot water into the sewers. Nuisances from arising vapor are often developed and additional radiators of a hot water type are sometimes required to cool this condensation and save the heat. This all costs money and a return trap is usually just as cheap.

Where a return trap is used it is customary to carry sufficient steam pressure on the line to operate the trap; about 15 lbs. should be ample. The trap is what is known as the "three-valve" or lift-

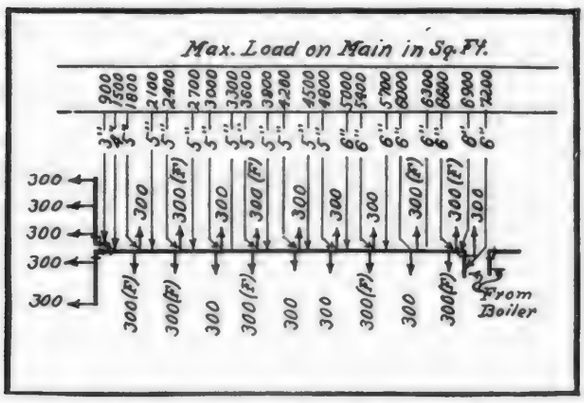



Fig. 4. Loads on Left Half of Steam Main.

trap variety and is so arranged that when it becomes filled with condensation it automatically opens the direct steam line into the top of the trap. This pressure drives the water out into the return main. As soon as the trap is emptied it returns to its original state by shutting off the steam, and opening again to receive the condensation until it is again filled.

The return of the water of condensation involves the use of a wet return, with a receiving tank in the central plant and a small boiler-feed pump to force the returns from the tank back into the boiler against the boiler pressure. The return line should be run in the same trench with the steam line to avoid any difficulties from freezing and each house should be connected with a valved emergency-connection to the drain for use in case any difficulty develops in this return line, although such difficulties will be rare in a properly-designed and well-cared-for system.

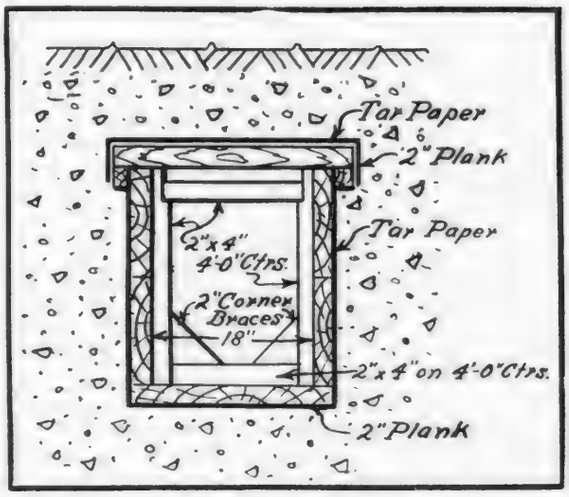



Fig. 5. Detail of Typical Wooden Trench

### RUNNING THE STEAM MAIN

Presuming that a suitable location for the plant has been found near the center of the block, the pipe line may now be considered. Of course, it will be necessary to arrange the piping so that every house which desires service can be connected to the lines and provision must also be made for future connections.

The easiest way to run such piping will depend somewhat on the position of the houses on the lots. In some localities the builders of residences are forced to keep back 30 ft. or so from the front lot line by local building restrictions, while, in other localities, the houses are set much closer to the street. All things considered, it is probably easier, and certainly cheaper, to run the piping in the rear of the houses as, in this arrangement, one main line can be made to serve the houses on both streets. If the piping is to run in front of the houses it not only means longer runs but double mains as well.

Such an arrangement is illustrated in Fig. 3 where the mains are shown running in the back yards through the entire block. If the sizes of residences are assumed to be such as to require an average of 300 sq. ft. of steam radiation each, then we have a steam main as shown in Fig. 3 and illustrated, as far as the left-hand half is concerned, in detail in Fig. 4. Adding up the load it is found that it totals approximately 7,200 sq. ft., to which must be added about 25% for the piping in the houses, making a total of 7,200 sq. ft. plus 25% of 7,200 for distribution losses, which equals 9,000 sq. ft.

### SIZING THE STEAM MAIN

Sizing this main on the basis of a 1-lb. drop for a 750-ft. total run we find that a 6-in. line will be required for about the first eight connections, 5-in. line for the next eleven connections, 4-in. line to the cross main, 3-in. line to the branch for the last two houses and 2-in. into the last houses on the

end of the main. If the main is dripped at the end of each branch of the cross main the 3-in. branch should be continued up to the drip connection. The drip connection may be placed at the second last house connection, with a small saving in pipe size and condensation loss.

### CONDENSATION IN STEAM MAIN

Having obtained the pipe sizes of the steam main it is now possible to figure the probable condensation losses likely to occur in the main during the most severe weather conditions so as to provide proper boiler capacity to take care of this. These losses are reduced, of course, by the application of proper insulation.

Taking off the lineals of pipe it is found that there are approximately:

| Length Lin. Ft. | Size In. Diam. |
|---|---|
| 100 | 2 |
| 150 | 3 |
| 40 | 4 |
| 250 | 5 |
| 160 | 6 |

Turning to the "Ideal Fitter" it is ascertained that the radiation from uncovered steel pipe is about 3 B.T.U. per degree temperature difference for each square foot of pipe surface.

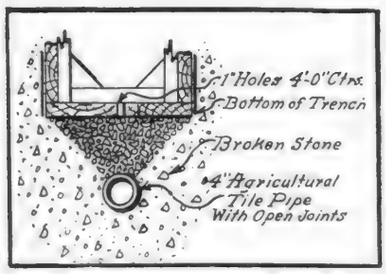



**Fig. 6. Blind Drain for Pipe Trench**

To play safe it may be assumed that the outside temperature will be zero and the temperature of 15-lb. steam about 250° F. Now, in reality, the temperature surrounding the steam main will never be zero, owing to heat radiated by the main itself, but, to obtain ample boiler capacity, this has been assumed to be on the safe side.

If the temperature difference is taken at 250° F. then, at 3 B.T.U. per square foot of surface per degree, the loss from each square foot will be 3 B.T.U. × 250, or 750 B.T.U.

Ascertaining the number of square feet on the pipe is simply a case of multiplying each lineal footage of each size by the number of square feet of surface per lineal foot for the particular size considered.

This gives the following:—

| Length Lin. Ft. | Size In. Diam. | Approx. Surface Sq. Ft. |
|---|---|---|
| 100 | 2 | 62 |
| 150 | 3 | 140 |
| 40 | 4 | 50 |
| 250 | 5 | 357 |
| 160 | 6 | 275 |
| | Total | 884 |

And for two sides multiply by 2.

Total for both sides, 1768 sq. ft.

Then 1768 × 750 B.T.U. equals 1,326,000 B.T.U., the loss from bare pipe.

### PIPE COVERING

To reduce the above losses the mains should be covered with a fair grade of pipe covering having an efficiency of at least 60%. This means that 60% of the loss will be prevented and only 40% of the computed loss need be provided for. Therefore, the loss will be only:

1,326,000 B.T.U. × 40% equals 530,400 B.T.U.

530,000/33,523 equals 16 plus boiler horsepower.

Another 4 boiler horsepower should cover the branches, making 20 boiler horsepower total.

### PERCENTAGE OF LOSSES IN STEAM MAIN

With only 20 houses connected the total load will be 300 sq. ft. × 20, or 6,000 sq. ft. To this must be added 25% for house piping, making 7,500 sq. ft., and the heat loss from the covered main line of 530,000 B.T.U., plus 25% for house service branches or 662,500 B.T.U., which is an equivalent of 2,650 sq. ft. Therefore, the total boiler load with 20 homes is 7,500 sq. ft. for the houses, plus 2,650 sq. ft. for the mains, or 10,150 sq. ft. total.

Under this condition the main loss constitutes: 2,650/7,500, or 35%. If, however, there were forty houses, the house load would be 300 sq. ft. × 40, or 12,000 sq. ft.

| | Sq. ft. |
|---|---|
| House load | 12,000 |
| 25% for house piping | 3,000 |
| | 15,000 |
| Mains and branches (as above) | 2,650 |
| Total | 17,650 |

In this case the main loss would be 2,650/15,000, or 17%.

This plainly demonstrates the greater efficiency due to the larger number of houses. If 70 houses are connected, using similar calculations, the figures would be:

| | Sq. ft. |
|---|---|
| 300 sq. ft. × 70 | 21,000 |
| 25% for house piping | 5,250 |
| | 26,250 |
| Main and branches | 2,650 |
| Total load | 28,900 |

and the main loss is only 2,650/26,250, or 10% plus.

The return main purposely has been neglected in these calculations, owing to the assumption that it will parallel the steam main in the same trench, so that the heat losses from this line will be nil.

(*Continued on Page* 76)

# Winners in School Ventilation Contest

## Competition Develops Wide Variety of Designs Ranging from Duct and Unit Ventilator Systems to Those Employing Gas Heaters and Hot Plates

HERE are the winners of THE HEATING AND VENTILATING MAGAZINE'S competition in school ventilation. The first prize of $50.00 was awarded to Harry W. Fiedler, chief engineer of the Burnham Boiler Corporation, New York. Mr. Fiedler's design scored the highest in the system of ratings devised to determine the relative merits of the answers submitted. His solution of the problem involves the use of a split system and is presented in detail on page 70.

Second place has been won by Edward R. Ronald of Louisville, Ky., who is accordingly awarded a prize of $20.00 and a year's subscription to THE HEATING AND VENTILATING MAGAZINE. Mr. Ronald adopted the fan-duct system in his design and, as will be seen from the score sheet, is clearly entitled to a place but slightly below that of Mr. Fiedler.

Third place with a prize of $20.00 and a year's subscription to THE HEATING AND VENTILATING MAGAZINE goes to C. P. Bridges of Hyde Park, Mass., for his solution of the problem, based on the use of unit ventilators. While missing out on two points considered as vital, nevertheless, the plan submitted by Mr. Bridges has so many excellent features that it stands out above all but the first two.

In a subsequent issue of THE HEATING AND VENTILATING MAGAZINE will be presented the second and third best solutions, as well as those of others, who displayed both originality and skill, in their handling of the problem.

**H. W. Fiedler**
Winner of First Prize in Competition

### BASIS ON WHICH DESIGNS WERE JUDGED

All designs submitted were considered on the basis of the ten factors designated in the A.S.H. &

| Designation | Type of Supply System | Type of Exhaust System | Air Quan. per C.R. C.F.M | Type of Filters (if any) | Air Washers Used | Provision for Humidity | Purification of Air | Quan. of Fresh Air % | Recirculation Included | Temp. Control Included |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Unit-Ventilator | Gravity-Flues | 1500 | Oil | None | None | None | 100 with Pupils Otherwise 0 | Yes | None |
| 2 | Fan-and-Duct | Fan-and-Duct | 1800 | Dry | Yes | Air Washer | Ozone | do | Yes | Yes |
| 3 | Unit-Ventilator (Third Prize) | Gravity-Flues | 1500 | Dry | None | None | None | do | Yes | Yes |
| 4 | Fan-and-Duct | Gravity-Flues | 1500 | Dry | None | None | None | 100 | No | ? |
| 5 | Split-Fan-Duct (Second Prize) | Gravity-Flues | 1500 | None | Yes | Air Washer | None | 100 with Pupils Otherwise 0 | Yes | ? |
| 6 | Hot-Blast | Gravity-Flues | 1500 | Dry | Yes | Air Washer | Ozone | 0-100 | Yes | ? |
| 7 | Split-Fan-Duct (First Prize) | Fan-and-Duct | 1500 | None | Yes | Air Washer | Ozone | 25-100 | Yes | Yes |
| 8 | Unit-Ventilator | Gravity-Flues | 1500 | Dry | Yes | None | None | 100 | No | Yes |
| 9 | Fan-and-Duct | Fan-and-Duct | 1500 | None | Yes | Air Washer | None | 100 | No | Yes |
| 10 | Comb. Unit-Duct | Gravity-Flues | 1500 | Dry | Yes | Air Washer | Ozone | 25-100 | Yes | ? |

**Chart Showing Tabulation of Main Features of Ten Best Designs Submitted**

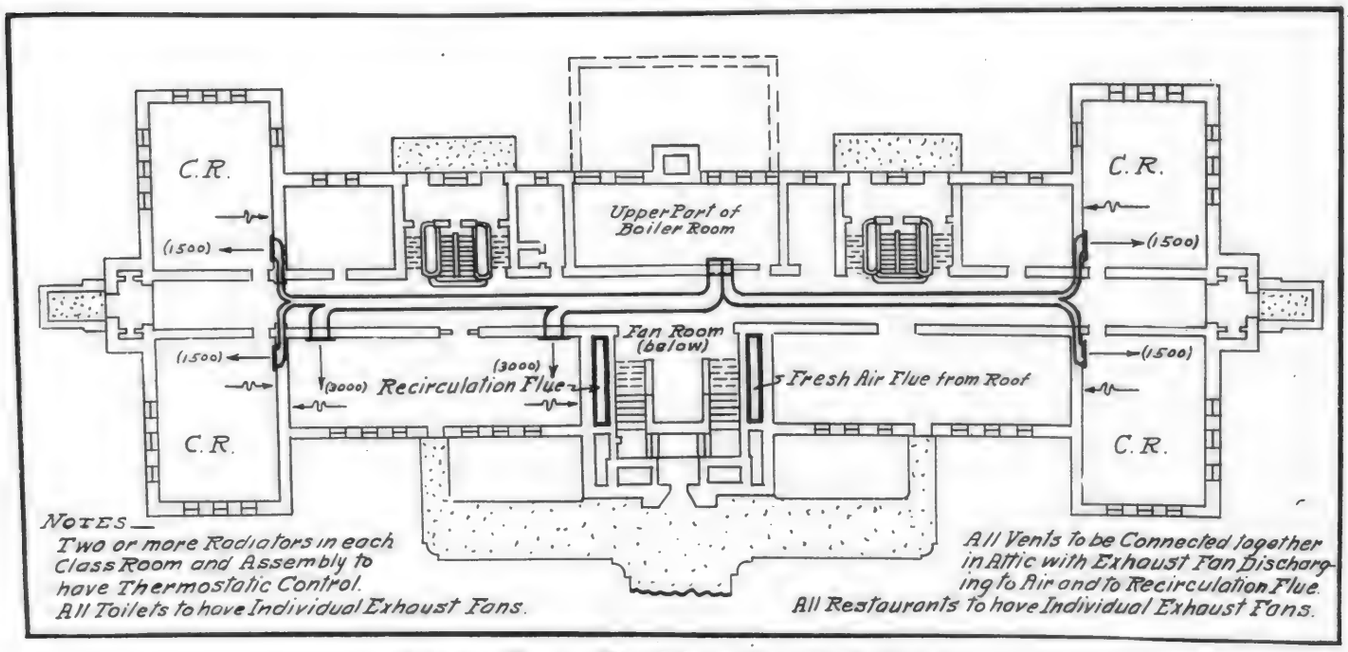

C.R.
(1500)
Upper Part of Boiler Room
C.R.
(1500)
(1500)
Fan Room (below)
(3000)
(3000) Recirculation Flue
Fresh Air Flue from Roof
(1500)
C.R.
C.R.
NOTES—
Two or more Radiators in each Class Room and Assembly to have Thermostatic Control.
All Toilets to have Individual Exhaust Fans.
All Vents to be Connected together in Attic with Exhaust Fan Discharging to Air and to Recirculation Flue.
All Restaurants to have Individual Exhaust Fans.

**Fig. 1. Winning Plan Submitted by H. W. Fiedler**

V.E. *Guide* as fundamental in producing proper ventilation:

1. Air supply.
2. Air temperature.
3. Air cleanliness.
4. Air sanitation with reference to its freedom from bacteria.
5. Relative humidity.
6. Distribution.
7. Air motion.
8. Freedom from odors.
9. Freedom from other injurious substances.
10. Freedom from monotony, with reference to noise and too much regularity of indoor conditions.

Preference was given to systems providing for delivery of a fixed and positive air quantity to each and every class room, this air being cleaned, humidified and tempered, and with automatic control. With the exhaust system, it was considered that the positive removal of a predetermined air quantity from each class room was necessary and, in order to operate at the greatest economy, recirculation should be employed, together with a split system of heating.

Recirculation naturally led to rewashing, dehumidifying and the use of ozone or some equivalent means for purifying and odor removal.

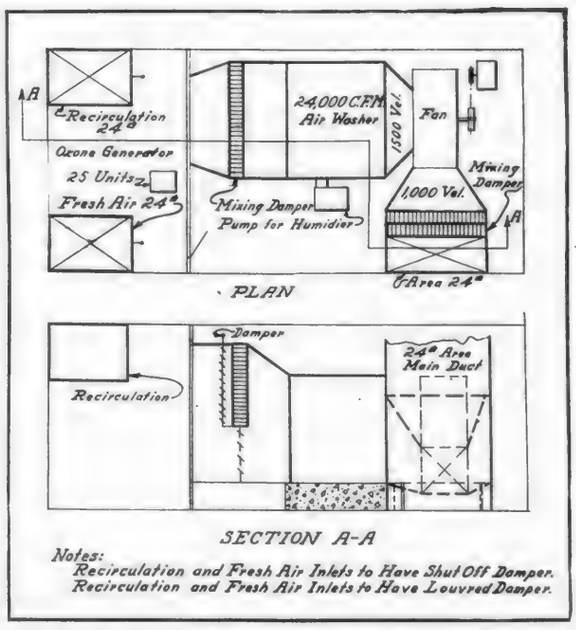



**Fig. 2. Detail of Fan Room as Submitted by H. W. Fiedler**

Where contestants propose systems of equal merit, the deciding factor of strict adherence to the terms of the contest was used to determine the preferred design of the two proposed methods. One reader connected with a manufacturing concern put himself out of the running at the outset by submitting for Question 20 a treatise involving about 3000 words, instead of 1000, in which sales talk predominated.

A tabulation of the ten most promising layouts submitted has been prepared to show the main features of what engineers to-day feel is the best ventilating design for schools. It is interesting to note that out of this ten 90% used a 30 cu. ft. per minute basis and 10% exceeded this standard.

Only 30% used fans on the exhaust; another 30% submitted schemes based on unit ventilators, while 60% favored the fan-and-duct supply system and 10% used a combination of the two methods. About 40% considered humidifying unnecessary and 70% used recirculation, but only 30% employed any treatment of the recirculated air for odors such as ozone.

One reader submitted what seems to be a very good layout, but failed to include his questionnaire answers and so could not be considered. Answers from England arrived too late to be considered.

The scheme proposed by the winner, H. W. Fiedler is shown in Fig. 1 with a detail of his fan room in Fig. 2.

### THE WINNING SYSTEM

Mr. Fiedler's answer to Question 20 is as follows:

"My system would be a vapor heating system, with direct radiation installed in each room, thermostatically-valved and controlled with a lock-key thermostat.

"I believe my scheme should be so arranged that the entire system would have to be used and would eliminate the possibility of each individual teacher using his or her judgment as to what is the proper temperature for the pupil.

"Ventilation to be beneficial should be centrally controlled.

"As proper ventilation can only be secured through mechanical means, my scheme allows for the most economical and efficient system of controlled heating and ventilation.

"To cut down the heating requirements in my scheme of direct radiation to a minimum, I would suggest that some type of good building insulation be used in the construction.

"I would install two low-pressure cast-iron boilers, equipped to burn buckwheat coal, each boiler capable of taking care of two-thirds of the entire load.

"The entire system to be under the supervision of a competent operator and controlled from a central control room."

*Next month the solutions receiving the second and third prizes will be presented and will be followed, in a subsequent issue, by some of the other schemes submitted, involving unique ideas.*

*In the near future another contest will be announced dealing with the ventilation of small motion-picture theatres.*

## Kansas Liberty Memorial

(*Continued from Page 65*)

be set for the actual specific gravity of the oil used.

All of the oil-piping is full-weight pipe, except the fill-pipe, which is bell-and-spigot, cast-iron, water-pipe. A 1-in. steam line is run to the main oil-storage tank, terminating in a coil of ¾-in. pipe run around the suction pipe (inside of the tank) and extends about 6 in. below the end of this pipe. The end of this coil is carried up through the top of the tank and is discharged to the drain.

### OIL PUMPS

To handle the oil, two Kinney oil pumps are installed with a capacity of 5 gal. of oil per minute against a total static head of 60 ft. The oil pumps are operated by a 1-H. P. motor and are set on foundations 12-in. high.

Two combination oil-pump-and-blower units are included in the oil-burning apparatus.

### EXHAUST SYSTEM

In ventilating the Memory Hall Building a Sturtevant exhaust fan is installed in the roof space and the exhaust ducts are run through the roof spaces and connected with the vertical flues. (See Fig. 8.)

For Memorial Hall, in the Memory Hall Building, a number of small perforations are provided in the ceiling through which the air is exhausted and blown out into the atmosphere. The cloak-room in the basement is ventilated by means of a ceiling grille connected to a galvanized-iron duct and carried up, and attached to, the exhaust system in the roof space.

### SHEET METAL WORK

Duct work in general is constructed of No. 24 U. S. gauge for sizes up to 24 in. in the largest dimension, No. 22 gauge for sizes 25 in. to 35 in. largest dimension and No. 20 gauge for anything larger than this.

The ducts are made up with lock-joints. Vertical ducts are supported every 10 ft. and horizontal ducts every 4 ft.

### EXHAUST FAN INSTALLATION

The exhaust fan is a top-horizontal-discharge, double-width, multiblade fan of Sturtevant make, and is set on a 6-in. x 3-in. yellow pine frame with beveled edges. Under the frame is placed a 2-in. layer of sheet cork, while the frames are secured to the floor by bolts and cork washers. The fan is driven by a Goodrich Commander Brand endless rubber belt.

On the discharge side of the fan is located a shut-off damper constructed of No. 10 galvanized-iron and attached to brass trunnions. This damper is opened and closed by an Ilg automatic damper-operator.

### DESIGNERS AND CONSTRUCTORS

The Liberty Memorial design competition was won by H. Van Buren Magonigle, who selected, as collaborators, Edith Magonigle, Robert Aitkin and George Kessler. Somewhat later, Jules Guerin, D. Putnam Brinkley and F. Lynn Jenkins assisted in various parts of the design. The construction work was carried out by the Westlake Construction Co., St. Louis, Mo., general contractor, with Tom Michell acting as superintendent on the work, and under the direct supervision of G. Gifford Symes of Mr. Magonigle's office. The heating work was designed by Clark, MacMullen and Riley, engineers, New York, and the installation was made by the Thomas L. Dawson Co., of Kansas City.

# Church Heating and Ventilation

*By Alfred J. Offner, M. E.*
Offner and McKnight, Consulting Engineers, New York City

**Part III**

## Design Problems in Houses of Worship as Affected by Their Construction and Use

**Interior of St. Michael's Church, Jersey City, N. J.**
Wilfred Edwards Anthony, New York City, Architect,
Gillis and Geoghegan, New York City, Heating Contractors.

SOMEONE has said that, as a rule, people in churches are not put to sleep by poor sermons, but by bad air. Whether this is so or not is questionable. If the church is not ventilated, why, then, the effect of drowsiness can be blamed on the condition of the air. If it is ventilated and some people still become drowsy or go to sleep, then the question, where to place the blame, can be fought out between the clergymen, who preach the sermon, and the engineer and contractor, who designed and installed the ventilating system. But, from actual observation, the fact remains that in churches which were without ventilation and in which ventilation later was provided, conditions of comfort became better. Again, whether to credit the improvement to better sermons, or to better air, depends on one's point of view.

In smaller church buildings, especially where the windows are so arranged that they can be opened, mechanical ventilation is not necessary. The air changes obtained by natural means generally will be found to be sufficient.

In larger houses of worship, the conclusion might be reached that, due to the short periods in which these buildings are occupied and the large cubical contents provided per person, no ventilation is needed. So far, this assumption seems correct, but, in most cases, it will be found that the windows, especially the clerestory ones, have very small portions that can be opened, or else, the entire windows are fixed. Therefore, in these cases, the doors giving access to the church provide the only means for changing the air. This, of course, would prove insufficient. For these reasons some form of ventilation must be provided, if only enough to move the air in the building. It may also be taken as a general rule that churches having heavy attendance and long services require some form of mechanical ventilation.

### HUMIDIFYING AND DEHUMIDIFYING

A combination of quantity and quality of air, air movement, temperature and humidity are the factors determining physical comforts obtained in a ventilated room. The first three can be easily obtained by any well designed ventilating system, but humidifying requires special additional and expensive equipment.

The most important problem in producing comfort conditions during the hot and humid summer months is the dehumidifying of the air. Cooling of large rooms during this period of the year, so successfully applied in theaters and certain industries, also can be applied to church auditoriums. So far, however, with the exception of one or two isolated cases, churches have not adopted cooling systems, due to the high cost of installation and operation.

### VENTILATION EQUIPMENT FOR ST. MICHAEL'S CHURCH

A typical example of how the air conditions in an existing church can be improved is furnished in the case of St. Michael's Roman Catholic Church, located in Jersey City, N. J. This church had a direct hot water system, the radiators being located under the windows. Although it was possible to open the windows, it was found, during crowded and extended services, that the air in the church became very bad. Therefore, it was decided to install a mechanical ventilating system.

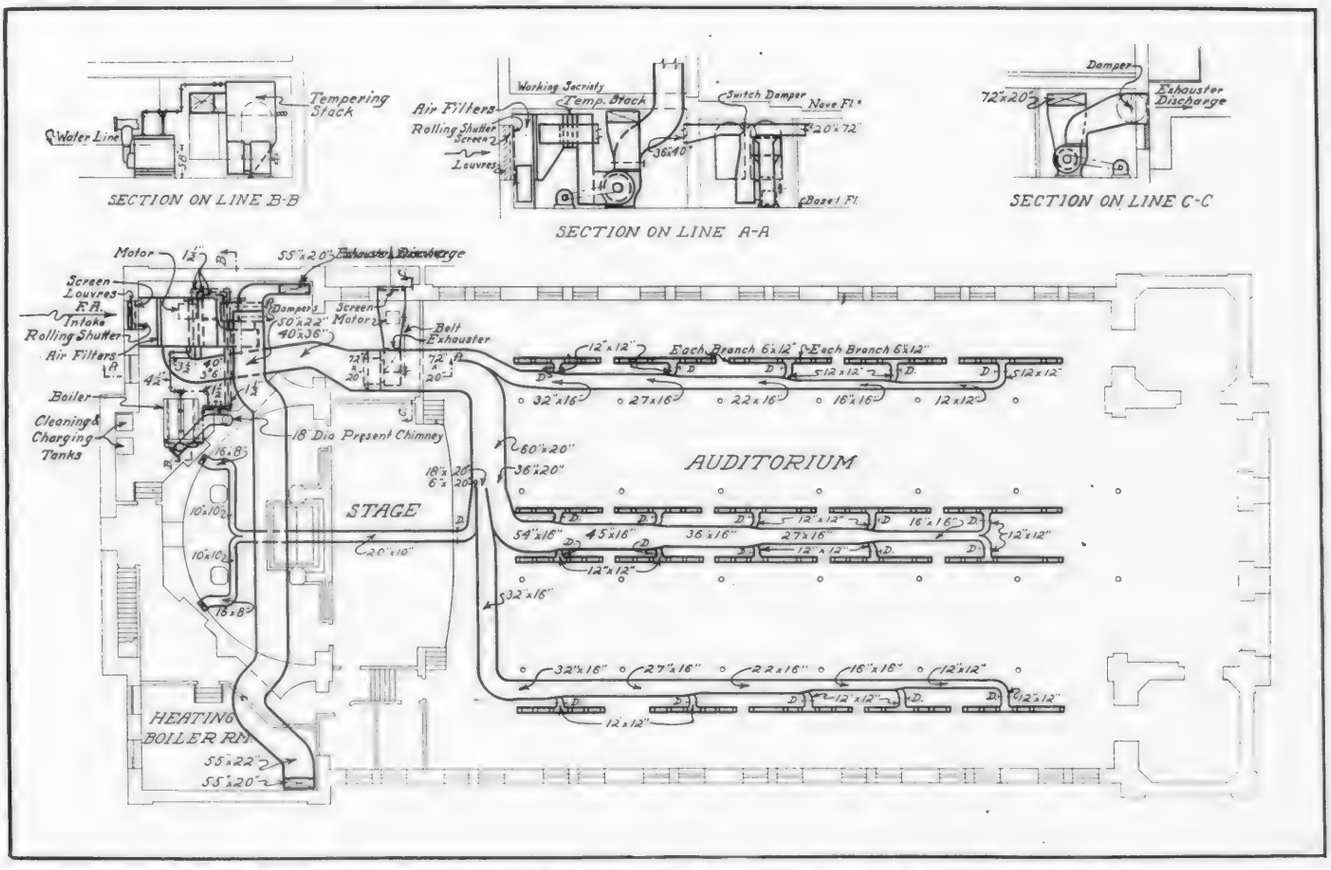



Fig. 18. Ventilating System in Basement, St. Michael's Church, Jersey City, N. J.

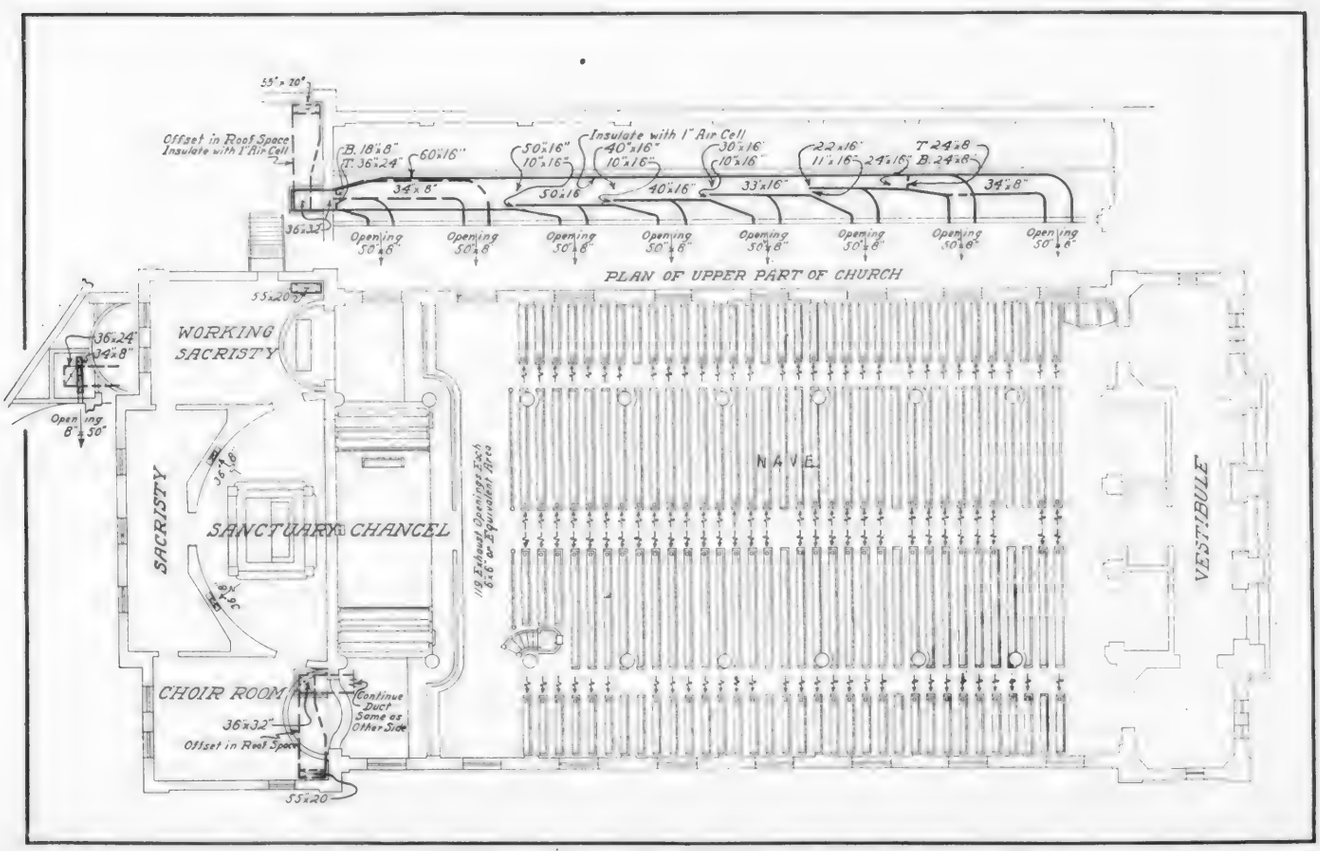



Fig. 19. Ventilating System in St. Michael's Church, Jersey City, N. J.

The results obtained in the improvement of the air condition have more than justified the cost.

A general idea of the arrangement of the ventilating system, as installed, is given in Figs. 18 and 19. The church is 70 ft. wide, 145 ft. long and 55 ft. to the highest part of the domed ceiling. There is a total seating capacity in the nave and chancel for 1400 persons. An air supply of 15 cu. ft. per minute, per person, is provided, the exhaust being taken as three-quarters of the supply, or 11¼ cu. ft. per minute per person. On this basis, the total air handled is 21,000 cu. ft. per minute supply, and 15,750 cu. ft. per minute exhaust.

### OVERHEAD AIR SUPPLY

Air supply distributing duct systems are located in the attic spaces over the two side aisles of the church, the air being discharged into the nave at the point where the domed ceiling, located over the center portion, meets the cornice line. This point is 35 ft. above the nave floor. Long, narrow slots form the outlets. They are installed without register faces, due to the fact that they are invisible from the nave floor. Each opening is 50 in. x 8 in. and is sized for a velocity of 600 ft. per minute.

Fresh air is taken from outdoors, filtered, tempered and discharged into the church by means of an electrically-driven blower. The two inner rows of the tempering stack are under automatic temperature control, actuated by a thermostat placed in the fan discharge duct and set at slightly over 70° F.

### AIR EXHAUSTED THROUGH PEW ENDS

Use is made of the pew ends for the exhaust air inlets, as shown in Fig. 20. Ventilated air from the nave is exhausted through these openings and carried through 6 in. x 6 in. flue connections to the exhaust collecting duct system, located on the ceiling below. The old existing 4½-in. diameter openings in the bottom of the pew ends were found to be of insufficient area and were supplemented by 7 in. x 3 in. openings formed under the pews, making the total net area the same as that of the connecting flue. These openings have no register faces or grilles over them. A plenum space, 7 in. x 7 in., is formed of wood under each pew end. The air velocity through the openings was figured at 600 ft. per minute. All of the exhausted air is handled by an electrically-driven exhaust fan, discharging to the outer air.

### BY-PASSING AND CONTROL OF AIR

A by-pass, with switch damper, is provided between the supply and exhaust systems, permitting the recirculation of the air. In actual practice, with the direct radiation turned off and the air recirculated, it has been found that it is possible to heat the church entirely by means of the ventilating system.

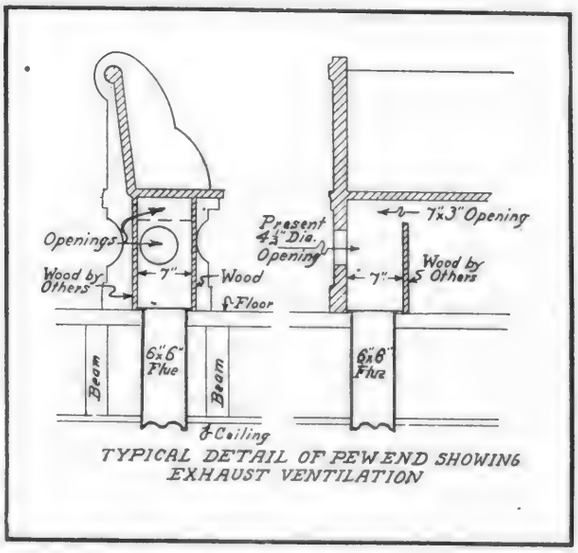
No volume dampers, however, are provided in the air-supply distributing system, the connecting necks having been sized for the quantities and velocities obtained at each junction. The exhaust ducts from the pew ends are grouped into branches having six connections each, each branch being controlled by damper. In actual operation even distribution is secured without the necessity of manipulating these dampers for equalizing the air flow.

### A CHURCH THAT HAD NO MEANS FOR NATURAL VENTILATION

Another interesting case is that of a church in New York City which is located on the rear of its property. The entrance to the auditorium is separated from the street front by stores and an office building, a long corridor serving for the entrance and exit. The front, rear and sides are hemmed in by adjoining buildings. All of the windows, facing areas and adjoining courts, are fixed. Over the auditorium is located a skylight having windows which can be opened and this presents the only means for natural ventilation. Under such conditions it is no wonder that ventilation was desired.

### UP-FEED SUPPLY SYSTEM

For this church the supply ventilating system proposed was of the up-feed type. Air is supplied




TYPICAL DETAIL OF PEW END SHOWING EXHAUST VENTILATION

**Fig. 20. Use of Pew Ends for Exhaust Air Inlets**

to the auditorium through adjustable 6-in. diameter cast-iron mushrooms located under the seats. One mushroom was placed under each alternate seat, making a total of 200 mushrooms in the auditorium. Fig. 21 shows the locations. The velocity through the mushrooms was based on a flow of 300 ft. per minute.

Of the total seating capacity of 800 persons, 465 seats are on the main floor, 319 in the gallery and

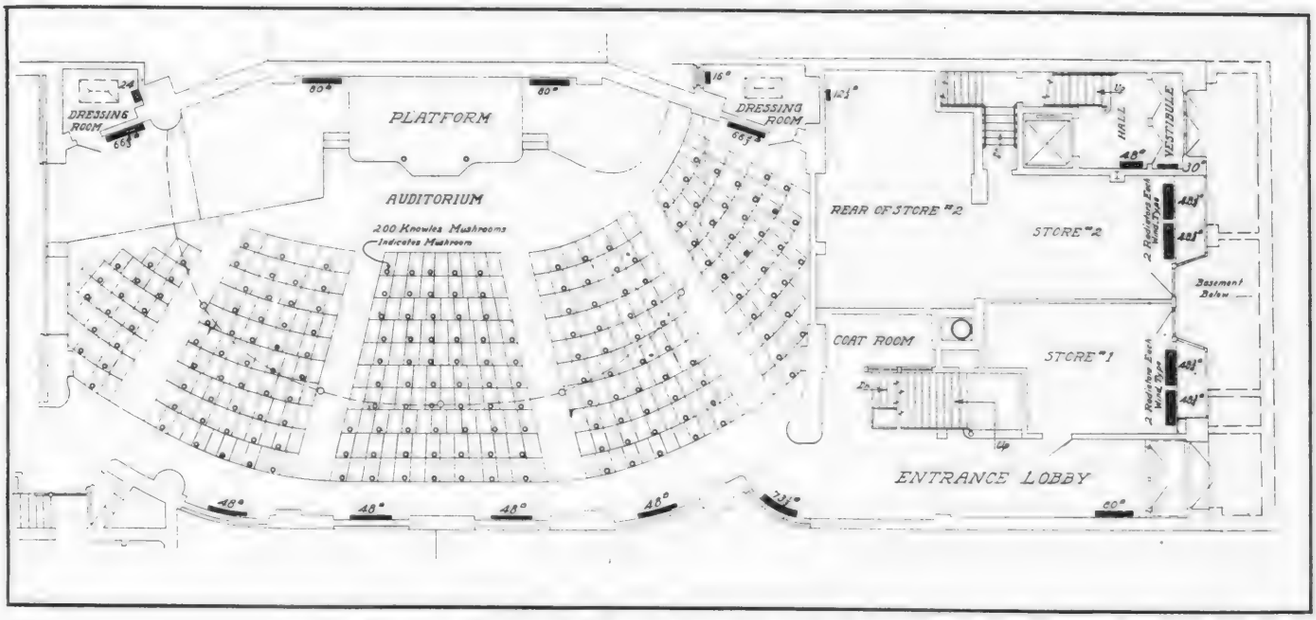



**Fig. 21. Mushrooms in Floor of Church in New York City**

16 on the platform. The air supply is based on 12 cu. ft. per minute per person, making a total supply of 9600 cu. ft. per minute.

On special occasions, when the auditorium is crowded and people are standing, as many as 1000 persons have been present at one time. With the amount of air supplied to the auditorium on these occasions, this air supply would give 9.6 cu. ft. per minute per person.

Dimension figures for the auditorium are: Width, 46 ft.; length, 80 ft.; and height, 30 ft. The actual cubical contents are about 95,500 cu. ft. On this basis, the air in the auditorium would be replaced six times per hour.

Fresh air is taken in 25 ft. above the court level through a heavy galvanized-iron flue, located on the outside court wall of the building. This air is filtered, tempered and mechanically-blown into the auditorium.

As will be seen from Fig. 22, the arrangement of the air supply distributing system has some unique features. The space under the auditorium is only a cellar and the wooden beams are exposed, there being no plastered ceiling. Certain spaces between the beams were made to serve as distributing ducts for the air supply by laying galvanized-iron over the bottoms of the beams and closing off the ends in the same manner. Fig. 23 shows a typical detail of this arrangement.

## GRAVITY EXHAUST VENTILATION

It was proposed to remove the vitiated air by means of gravity, thus no fans were provided. Air

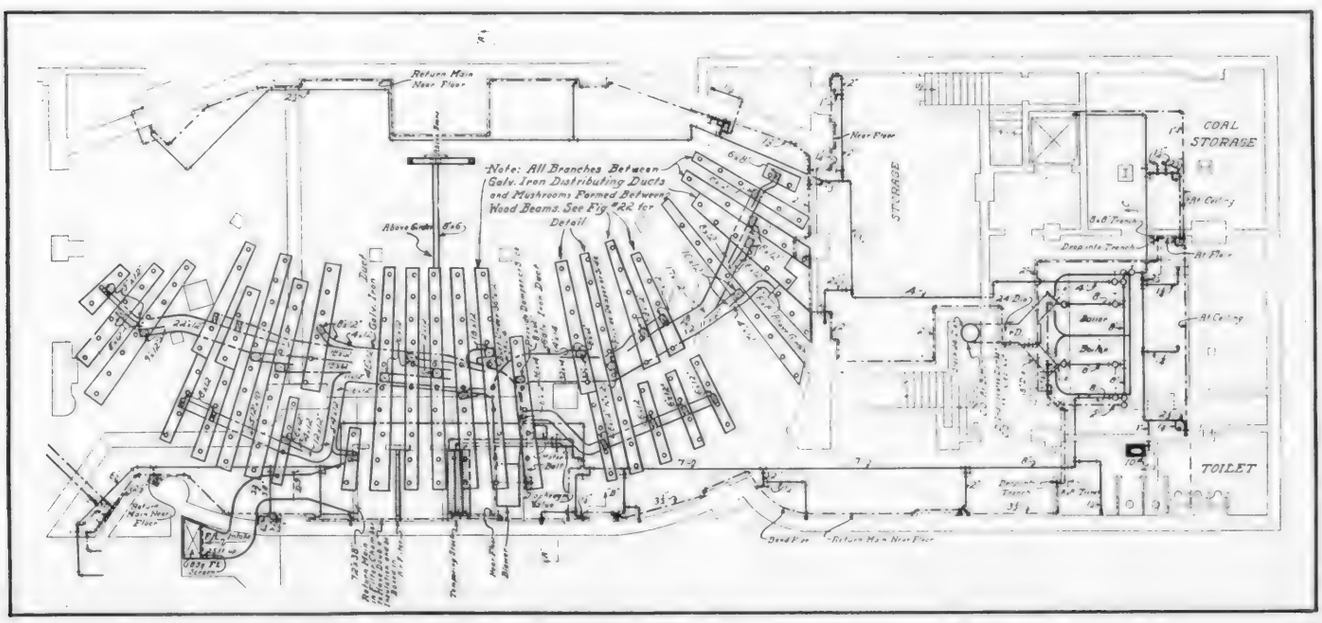

Return Main Near Floor
Note: All Branches Between Galv. Iron Distributing Ducts and Mushrooms Formed Between Wood Beams. See Fig "R2" for Detail
STORAGE
COAL STORAGE
TOILET

**Fig. 22. Duct Work under Auditorium Floor of Church in New York City.**

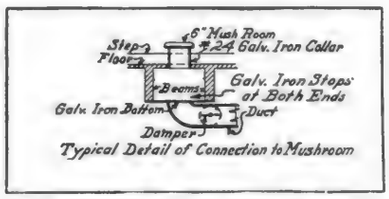



**Fig. 23. Boxing in Floor Beams to Serve as Ducts**

is exhausted through four large ornamental plaster openings located in the ceiling, supplemented by six exhaust registers placed under the floor of the gallery. In order to keep the connecting duct work concealed in the ceiling, it was confined to the spaces between the deep girders. As a result, it was necessary to discharge the vitiated air at three points. Each discharge point is provided with a stationary ventilator, with a damper to prevent the excessive escape of heated air when the supply system is not in operation. The arrangement of the exhaust ventilating system is shown in Fig. 24. A cross section of the building, indicating in general the supply and exhaust ventilating systems, is illustrated in Fig. 25.

The ventilating system just described shows what can be done in an existing building. It should be added that a steam system was installed to heat the church proper and the adjoining office buildings.

*(To be continued)*

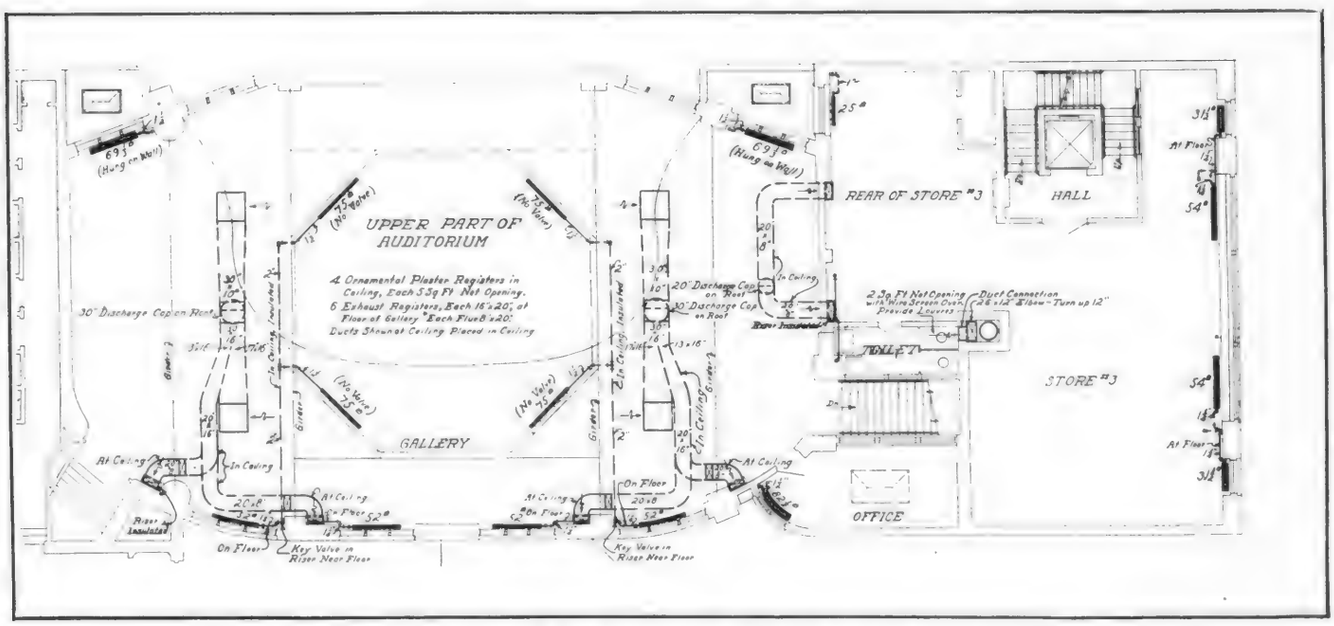

UPPER PART OF AUDITORIUM
4 Ornamental Plaster Registers in Ceiling, Each 5.5q Ft. Net Opening.
6 Exhaust Registers, Each 16"x20" at Floor of Gallery "Each Flue 8"x20" Ducts Shown at Ceiling Placed in Ceiling
GALLERY
REAR OF STORE #3
HALL
STORE #3
OFFICE
TOILET
30" Discharge Cap on Roof
20" Discharge Cap on Roof
10" Discharge Cap on Roof
Key Valve in Riser Near Floor
Key Valve in Riser Near Floor

**Fig. 24. Upper Part of Auditorium Showing Exhaust Ventilation, Church in New York City**

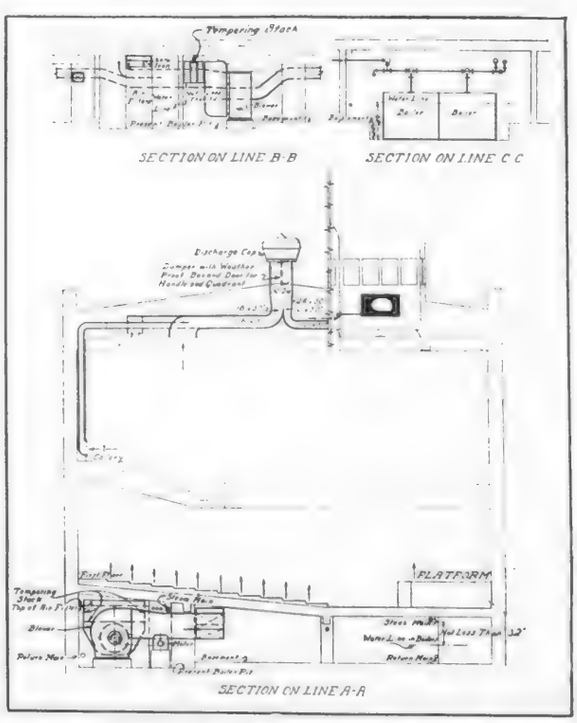



**Fig. 25. Elevation of Supply and Exhaust System, Church in New York City**

## Design of a Small Community Heating Plant

*(Continued from Page 68)*

There are various ways to run the steam main, some cheap and fairly good, and others more expensive and somewhat better. The simplest form of trench consists of a wooden box buried underground and preferably painted with asphaltum or other wood-preservative to protect the wood against dampness. A typical detail of such a wooden trench is shown in Fig. 5, this being of such simple construction as to be self-explanatory.

The trench also should be graded to match the grade of the steam main, and suitable access boxes should be provided for the reception of any steam traps required.

The simplest form of drainage is a blind drain of broken stone and cheap agricultural tile under the box, as shown in Fig. 6. *(To be continued)*

# PIPECRAFT

## PART III

A MODIFICATION of the pipe bend is sometimes used for the offset idea shown in Fig. 5, as illustrated in Fig. 8. It will be seen that 90 deg. pipe bends are substituted in place of the 90 deg. elbows previously illustrated. Some designers argue that such bends are more flexible and of greater strength than the 90 deg. fittings. This may be, and probably is, true, but a great deal is discounted from this argument when one stops to consider that such bends are almost always impossible to install without the use of unions, either screwed or flanged, to connect the bends up with the risers.

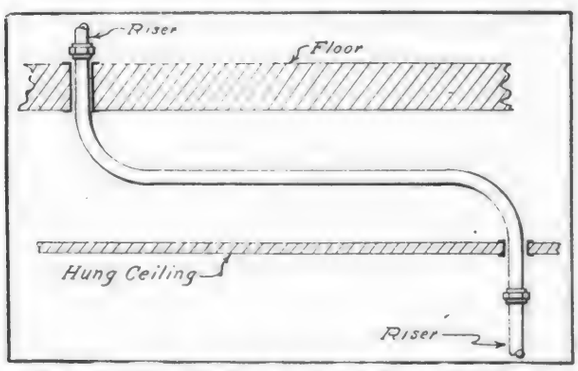



**Fig. 8. Use of Pipe Bends in Place of 90° Ells for Restricted Space Conditions**

### Use of Unions

While there are a lot of unions used on heating work and a great many of them remain tight for indefinite periods of time, still there is a deep-rooted idea in the trade that unions are not sufficiently dependable to be placed on furred-in pipes, such as risers. A packed slip-joint expansion joint is even worse as these joints must be kept accessible for inspection and repacking. Where the risers are exposed in finished rooms the matter of appearances makes unions highly objectionable and expansion joints absolutely taboo.

### Support of Risers

Assuming the risers are erected, branch outlet tees correctly located and expansion provided for, the next matter is the proper support of the risers and the necessary anchoring to control the expansion so it will concentrate at the points where means have been taken to care for it.

As a general principle it may be stated that it is usually better to support the risers at the point of largest size of pipe in order to secure structural safety in the riser. This logically leads to the supporting of "up-feed" risers at the *bottom* and "down-feed" risers (or *drops* as they should more correctly be termed) at the *top*.

If an expansion device of any character is installed in the riser, both sections on each side of the expansion joint must be supported separately.

To demonstrate the soundness of the above principle it is easy to see that, on a "down-feed" *drop*, beginning at the top with, say, a 2-in. pipe and decreasing in size as it proceeds down to the lower floors, ending up, perhaps, in a ½-in. or ¾-in. drip, it would be ridiculous to attempt to support the heavy 2-in. pipe by having it balanced on the top of the drip pipe. In this case the drop should by all means be supported at the top.

With the "up-feed" riser the case is almost as plain; supposing again that the riser commences with a 2-in. *pipe at the bottom* and proceeds upward gradually reducing in size until at the top it only consists of a ¾-in. pipe, it would be almost

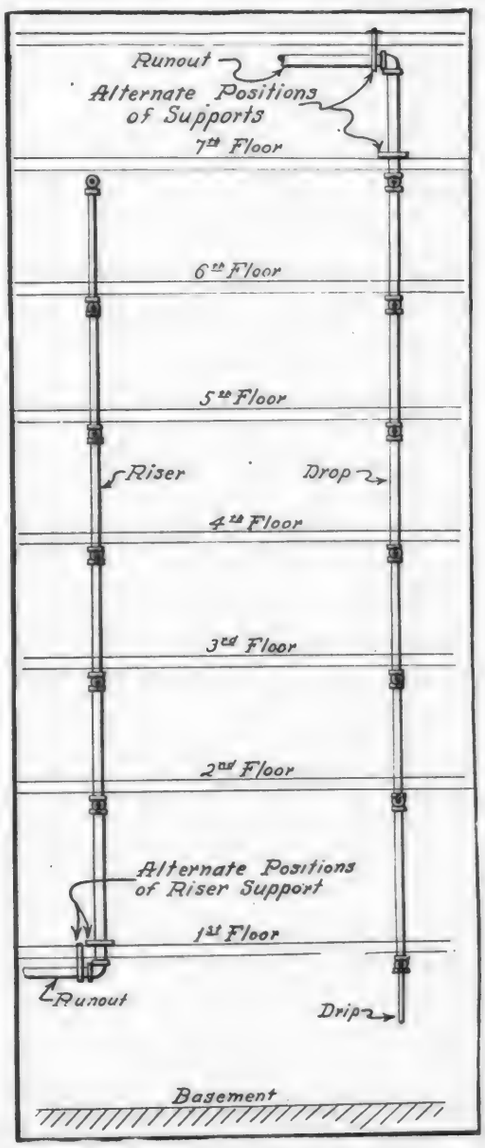



**Fig. 9. Correct Locations of Hangers on Risers and Drops**

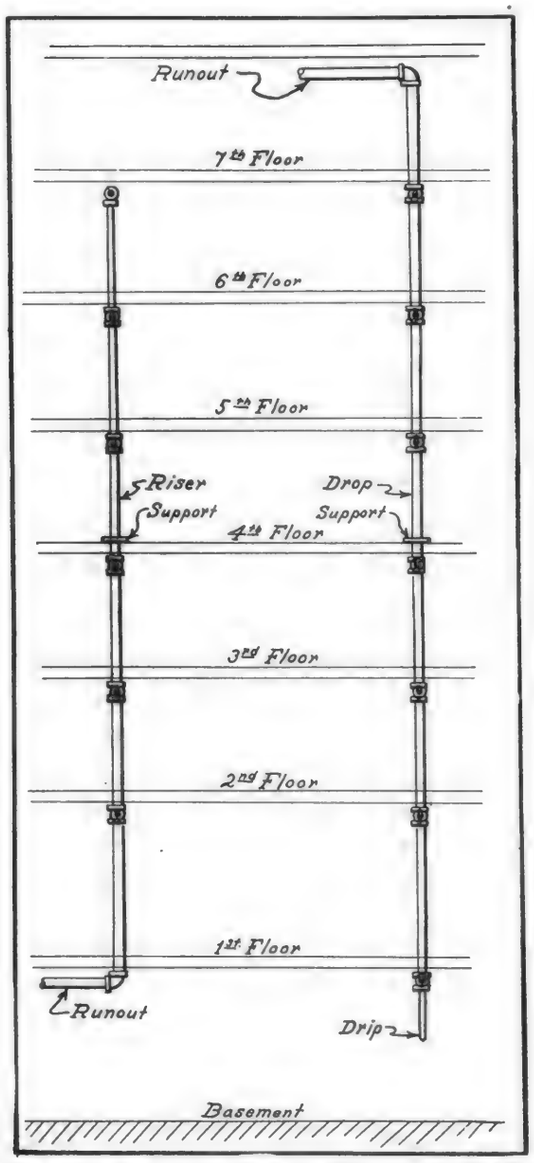



**Fig. 10. Example of Placing Support at Middle of Riser to Minimize Expansion**

as unreasonable to suggest dangling the whole riser on the small ¾-in. pipe. Therefore such a riser should be supported at the *bottom.*

It does not necessarily follow that the support should be placed immediately next to the top or bottom elbow, but rather that the support should be placed at the first solid floor construction through which the riser or drop may pass. The correct placing of supports for both risers and drops is indicated in Fig. 9.

## Minimizing Expansion

As an alternative it is sometimes permissible to put supports in the middle of short risers or drops, with the idea of minimizing the expansion movement in this way. With a support at either top or bottom, all the expansion of the whole line goes toward the opposite end. When placed in the middle, the support causes the expansion to divide —one half going toward the top and the other half going toward the bottom. A typical example of this arrangement is shown in Fig. 10 in which a total expansion in the riser or drop has been assumed as ½-in. With a support at the bottom this means that the top of the riser will go *up* ½ in. when heated, and similarly with the support at the top of the drop, the bottom end of the drop will come *down* ½ in. when heated.

A support in the middle divides this movement, the top ends of both risers and drops going *up* ¼″ and the bottom going down a like amount.

## Effect of Expansion Devices on Supports

The introduction of an expansion device in the riser or drop alters the method of support quite materially. In that event, it is almost imperative to anchor the section of riser or drop *beyond the expansion device* in the *middle.* The portion of the riser or drop between the expansion device and the runout from the main also may follow the practice of support at the top or bottom, as already explained, or it, too, may be hung in the middle.

Referring to Fig. 11, at "A" will be seen a riser, say, 100-ft. high, with a total expansion of 1-in. and with an expansion device in the middle. In "A" this riser is shown supported at the base, and midway between the expansion joint and the top of the riser. At "B" the same riser is shown supported in each section by hangers placed between the expansion device and the ends. At "C" a drop of about the same height is shown, with an expansion joint and a support at the top and another midway between the expansion device and the bottom; at "D" the same riser is illustrated with sup-

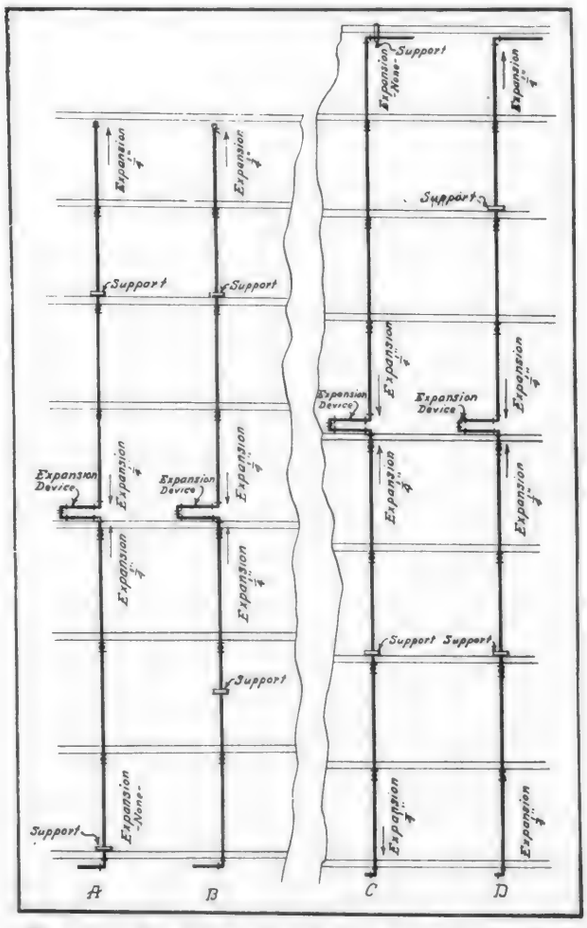



**Fig. 11. Four Different Schemes of Support with Expansion Device in the Line**

ports midway between the expansion device and each end.

As the expansion is proportional, running from zero, at the point of support, up to a maximum, at the farthest point, it is interesting to study the expansion effects of the different methods of support, as shown graphically in the diagrams given in Fig. 12. Here the amount of expansion or movement for each riser or drop can be read at each floor and the diagrams are lettered to correspond with the risers and drops, as noted in Fig. 11. It will be seen that with expansion devices and midway support, the expansive movement is only half as much as when supported at the base or top; of course, as the section of riser or drop beyond the expansion device is always anchored in the middle, the movement in this portion is the same in every case.

## Types of Supports

After having determined where the supports ought to go, the next thing to decide is what kind of a support should be used at these points and, also, how the riser or drop is to be kept in its place at other floors which are not points of support. It will be remembered that a support, of the type that firmly clamps the pipe and holds it in structural

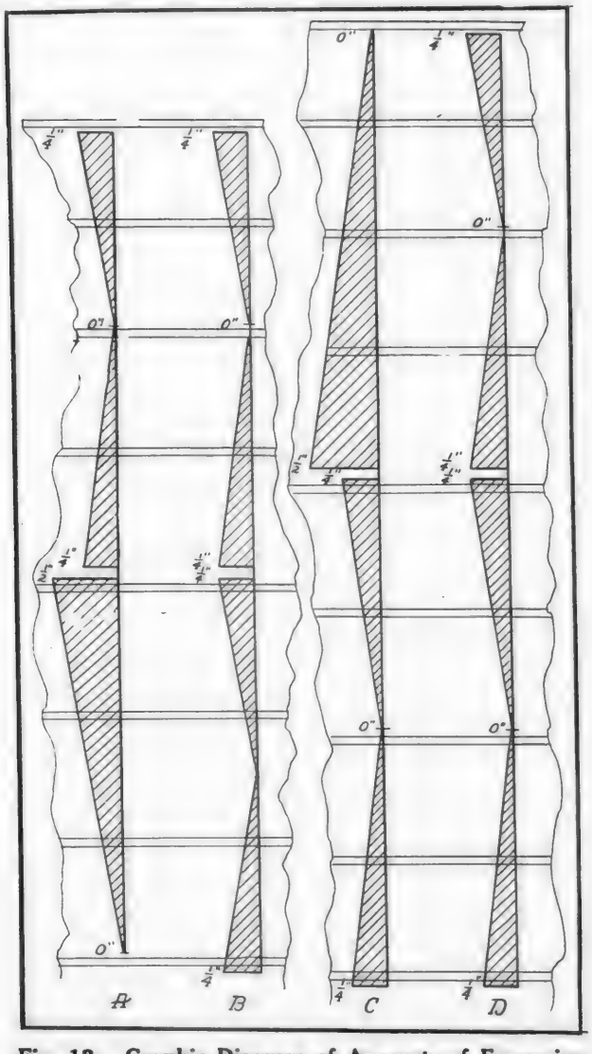



**Fig. 12. Graphic Diagram of Amounts of Expansion for Fig. 11**

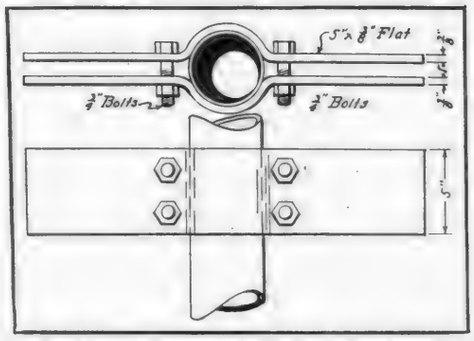



**Fig. 13. Common Type of Riser Anchor**

position, is termed an anchor, while a support which only guides the pipe, leaving it free to move in one or more directions, is termed a pipe hanger, or guide.

## Riser Anchors and Hangers

A very common form of riser anchor is illustrated in Fig. 13. This anchor consists of 5-in. × 3/8-in. flat iron with double bolting so as to clamp the pipe in a good tight grip. The straight ends project outwardly on each side of the pipe. To prevent the anchor from extending above the finished floor, it is usually cut down into the concrete slab 2-in. or 3-in. After setting in final position the riser is blocked so that it cannot move. Then a little cement mortar is poured into the depression and this cement brought up to the top of the anchor so as to make it practically an integral part of the floor construction.

At points where the riser or drop must slip on account of expansion, but must still be maintained in true lateral position, a pipe hanger or guide is used. This is similar to the anchor just described

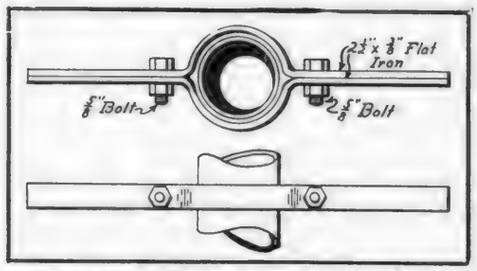



**Fig. 14. Modification of Anchor So As to Act Only As a Guide**

but has only a single bolt on each side of the pipe and is made of 2½-in. × ¼-in. or 2½-in. × 3/16-in. flat iron, as illustrated in Fig. 14. A most important feature of this guide is that the interior opening for the pipe, when both sides of the guide are brought together, should be still ¼-in. larger than the outside diameter of the pipe. In this way it is impossible for a careless mechanic to screw up the guide to a point where it will grip the pipe. These hangers, being only 2½-in. high, need not be cut into the concrete floor slab but are usually embedded in cement mortar to hold them in proper position after the riser is permanently set.

*The next installment of this article will take up the subject of radiator runouts and their arrangement to secure circulation, as well as to provide for expansion in the riser.*

*This is the twenty-second lesson (continued) of The Heating and Ventilating Magazine's*

# New Home-Study Course in Gravity Steam and Water Heating

## Lesson No. 22 (continued)—Piping and Connections

*By Ara Marcus Daniels*

THE design of a system of steam heating embodies considerably more than establishing radiator sizes and proportioning pipe lines. Three fundamental requirements must be observed when designing and installing a system of steam piping. They are:

1. That provision be made for expansion.
2. That proper means for draining condensation from the steam main and other parts of the system and returning same to the boiler be provided.
3. That due regard be given to the arrangement and use of pipes of proper size so that pressure drop will not be excessive.

In preceding lessons proportioning of pipes was covered for the different systems described. While it is possible to lay down certain rules, the use of which will go far toward producing a correct design, yet every student should realize that practically every design and installation presents its own individual peculiarities. The true student, therefore, will accept principles as fundamentals and will apply principles as covered in a work of this kind according to his judgment.

### EXPANSION

When a system of piping is installed, it is cold as compared with conditions to which it is subjected during operation. When metal is heated, it expands. A steam pipe, 100 ft. long, installed at a temperature of 60°F. will be somewhat longer when filled with steam. The heat in the steam causes the pipe to lengthen, demanding installation in such a way as will protect it from breakage when in use. Provision for linear expansion of pipes due to temperature changes must be made. Otherwise the design will be faulty.

Low-pressure heating systems are subjected to temperature differences from 150° to 180° and higher. Unless compensating provision be made, excessive and often serious strains on the pipe and fittings occur. A rough rule for low-pressure piping is to allow 1 in. expansion for every 100 ft. of pipe. By so doing, "bowing" of the line and enormous strains on fittings and flanges are guarded against.

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When a system of piping is being designed, a point in the line should be selected and the pipe assumed to be fixed or anchored at that point. A comprehensive study should then be made to determine the amount and direction of the expansion. In this manner, the elongation of all parts can be cared for properly.

Expansion in a steam heating system may be absorbed in two general ways:

(a) by the turning of some of the threaded joints;

(b) by the bending of the pipes.

The first method is preferred, by far, to the second, and should always be employed where the expansion is liable to be appreciable. While the second method may be permissible for conditions where expansion is slight, there is always the danger of sagging or bowing pipes, accentuating the undesirable possibility of reduced area. The illustrations in Fig. S-7-3 show how improperly-graded or installed pipes form pockets and it may be appreciated how a further sagging, with consequent greater pocketing due to failure to consider expansion, can aggravate the trouble and not only cause hammering and pounding throughout the system but possible severe damage.

When pipe runs are very long, as in power plant

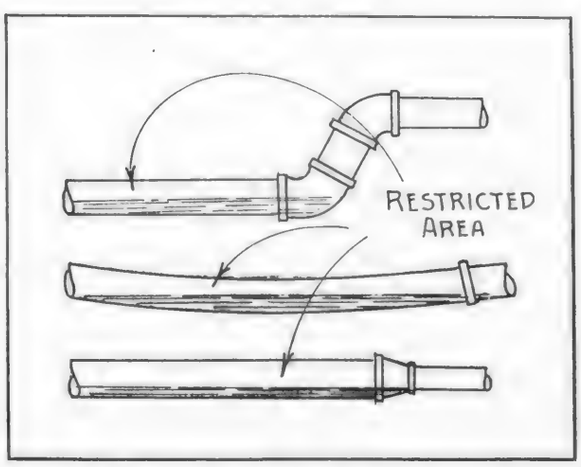



**Fig. S-7-3. Improperly Graded or Installed Pipes Form Water Pockets**

work, with consequent increased temperature differences, special slip-joints or expansion fittings may have to be used, but they should be avoided in heating work whenever possible.

### DRAINAGE

All pipes carrying saturated steam contain some proportion of water. In connection with some of the systems covered in preceding lessons, it was explained that certain of the pipes carried water due to condensation in the pipe itself as well as from other pipes and from radiators. It is important, therefore, that proper conditions of flow and drainage exist. In horizontal runs, it is considered highly advisable that the water flow in the same direction as the steam. In such systems as previously covered, a pitch of at least 1 in. to 10 ft. was specified for the supply lines, the pipe being pitched in the direction of flow.

For conditions where condensation must be drained against the flow of the steam as in radiator runouts for single-pipe systems or in a branch to a riser, a still greater pitch should be provided and relatively larger pipes used in order to assure a low steam velocity. Drip connections must always be provided where any pocket or low point might permit water to accumulate.

### PIPING DETAILS

Construction details and the design of the piping system is often considered by many so-called heating engineers as rather an unimportant feature of the heating system. This is unfortunate for, regardless of the merits of the apparatus and equipment which may be used, they will not compensate for improper design. Heating is a real science and when appreciated as such, the many heating troubles caused by guesswork in design or installation are eliminated. One authority pointedly has remarked concerning the piping system that "it is just as important as the circulating medium (the veins and arteries) is in the human system." Hence, carefully-considered and prepared piping layouts and details return dividends many times in satisfactory and rewarded service.

Expansion in horizontal mains customarily is considered by assuming the main as anchored at the boiler and permitted to expand freely from that point. Thus the movement of any point along the length of pipe will depend upon the distance of the point from the fixed or anchored point.

#### Work Problem S-7-4

Detail A and B of Fig. S-7-4 show methods of connecting branches to the main whereby provision is made for movement due to expansion. As the main moves longitudinally, the threaded joints a, a, turn slightly. While the method at A is accepted, detail B is to be preferred to it since a 45-degree elbow offers considerably less resistance to the flow of steam than the 90-degree elbow. Expansion also occurs in the horizontal branch. This expansion is usually cared for by permitting the riser to spring slightly and, since a branch is seldom over 10 ft. long, the spring required is not sufficient to be at all dangerous. Such a piping arrangement, as shown in detail B, can usually be expected to care for expansion at these points in buildings as high as four stories.

#### Work Problem S-7-5

When the main, either vertical or horizontal, is long, that is, 100 ft. or more, an expansion joint must be provided for each 100 ft. or fraction thereof. Detail C of Fig. S-7-4 shows a method of connecting the branch to the main to provide for greater expansion.

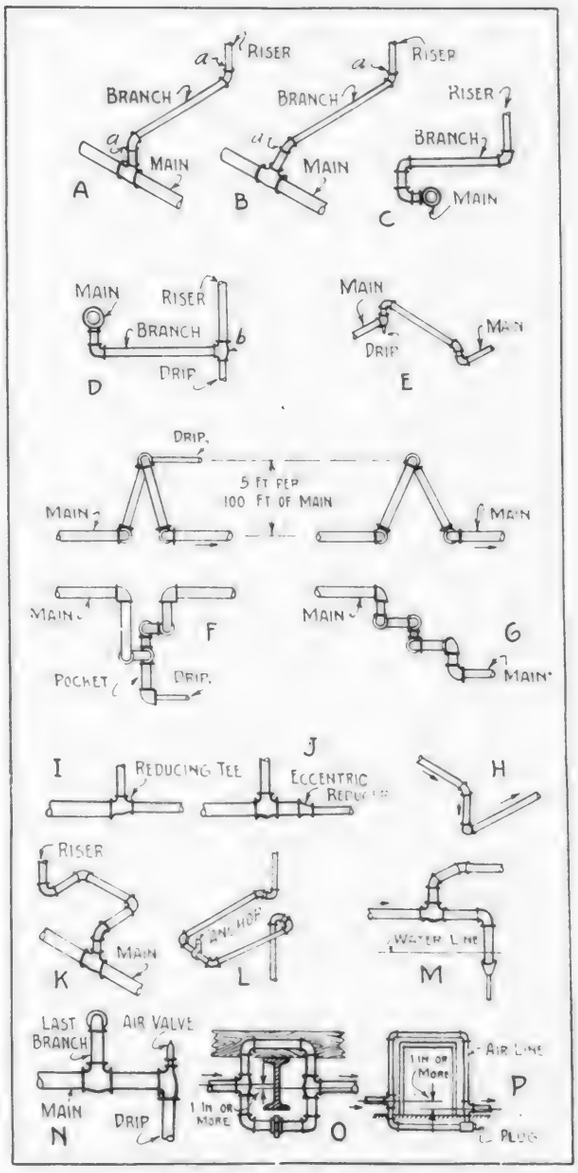



**Fig. S-7-4. Piping Details**

#### Work Problem S-7-6

Detail D, Fig. S-7-4, illustrates the method of piping where a branch is taken from the bottom

of the main as in the case of the one-pipe relief system covered in Lesson S-4. The objectionable feature to be observed in this arrangement is that if the water level rises in the return piping to a point above the horizontal or branch connection to the riser as at b, detail D, the riser will be completely sealed from the main and its steam supply closed. This is a practical objection to the one-type relief system and should always be borne in mind when designing this type of system.

**Work Problem S-7-7**

Details E, F and G, illustrate approved methods for making what is commonly referred to as a "swing" or "swivel" connection. It is essential that all branch connections should be made so as to allow a "swing" at the main and at the other end. When using a "swing" or "swivel" connection, it is necessary to anchor the pipe at two or more points. The expansion is taken up by a slight turning at the screwed joints. The arrangements, however, shown as details E, F and G, offer increased resistance due to the extra fittings used and should have proper consideration.

**Work Problem S-7-8**

Detail H, Fig. S-7-4, may be used with care where a main makes a turn of 90 degrees. Under such circumstances, expansion is partly absorbed by the spring of the members.

**Work Problem S-7-9**

Details I and J, Fig. S-7-4, illustrate a proper and improper method of reducing the size of the main on the run. The use of a straight reducer as per detail I permits water to accumulate in shallow pockets, reducing the pipe area, and resulting in water-hammer when starting up the circulation. Detail J shows the proper method whereby the use of an eccentric reducer will avoid this impractical condition.

**Work Problem S-7-10**

EXPANSION IN RISERS

Expansion in risers in small buildings where the supply mains are in the basement is usually downward and the movement is provided for by the slight spring of the branches and by the turning of screwed fittings connecting the branches to the main as already explained.

In larger buildings with a main in the attic, the risers are anchored near the middle of their length and expansion is permitted to take place in both directions. When the usual branch connection at the top and at the bottom of the riser cannot handle properly the total expansion, a flexible connection for the riser as shown in detail K, Fig. S-7-4, must be used. This provides a swivel joint and is especially suitable when the basement main must be installed near the foot of the riser. Although the additional resistance, due to extra fittings, is a disadvantage, it is outweighed by the flexibility provided. This arrangement may generally be expected to care for expansion in risers for buildings as high as eight stories.

**Work Problem S-7-11**

The illustration shown as detail K, Fig. S-7-4, is known as an expansion loop and is used for risers in buildings having more than eight stories. It can be expected to care for expansion and provide suitable flexibility for four stories on each side of the anchor.

**Work Problem S-7-12**

DRIP CONNECTIONS AND VENTS

Detail M, Fig. S-7-4 shows an accepted satisfactory method for dripping a main where it rises to a higher level, while detail N, same figure, illustrates a drip and vent connection for the end of the main. Air accumulates in the system, especially when it is not under steam, and when started up, the air is forced to the end of the main or other air-pocket locations. All piping designs should be finally studied and all air pockets located. At each such point air valves should be specified.

Where there may be more than one main, two or more drips from different mains should not be connected to one another above the water line since the pressure of the steam in them may not be the same. The result will be interference in the flow of condensation with consequent water-hammer.

(*Continued on Page 87*)

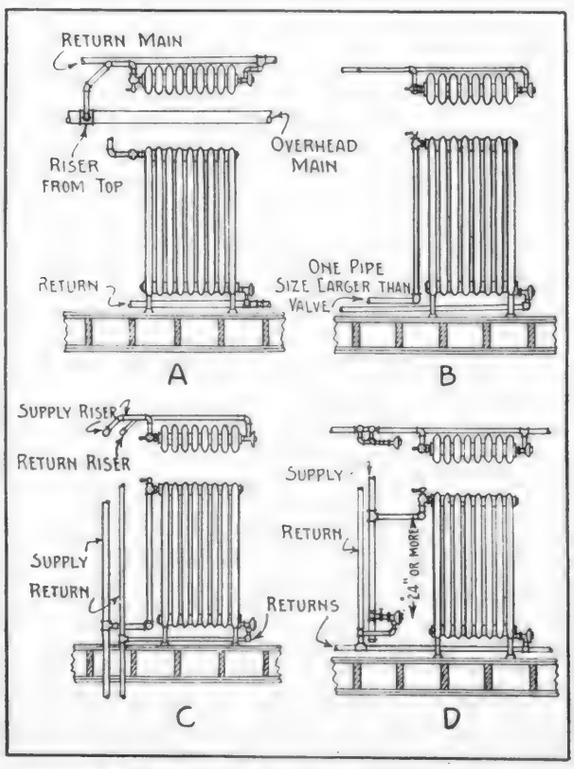



**Fig. S-7-5. Radiator Connections**

Auditorium of Beaumont High School, St. Louis, Mo.

# The Mechanical Ventilation of the St. Louis Schools

AN ENGINEERING STUDY

*By Edwin S. Hallett*

Chief Engineer, St. Louis Board of Education.

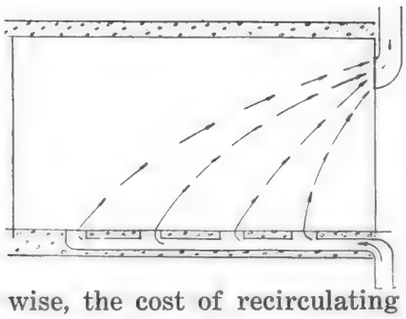
## Part III

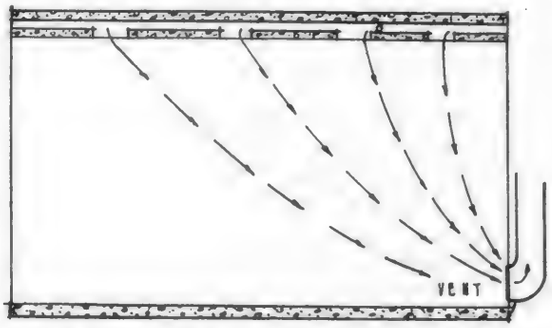
AS the house built upon the sand must fall, so the building of heating and ventilation upon false theories and misconception of facts must fail. Engineers and health officers have striven at cross purposes, due to lack of information at certain points. The most important of these pertain to the behavior of the several air currents within the school room.

### FLOOR AND CEILING DIFFUSERS

Attempts have been made to introduce warm air through small openings in the floor. This carries dust and odors from the floor, feet and clothing in a hot breeze upon the face. It defeats the main purpose of ventilation in that it does not produce air motion in a manner to give a comfort sensation through the removal of excess heat. The use of such distributed openings for venting the return air, however, would be justified in some large auditoriums. All air movements not horizontal should be floorward.

Likewise, the introduction of air through the ceiling not only fails in its main purpose of producing sensible air motion but such air streams cut down across any other currents that may exist. When air has been conditioned and introduced through the use of a fan it should be utilized to the fullest extent. It should sweep horizontally as far as possible before escaping into a vent register. Other-






(Left) Elevation Showing Air Movement in School Room With Floor Diffusers.

(Right) Elevation Showing Air Movement with Ceiling Diffusers.

wise, the cost of recirculating the air has been wasted. Such down-currents take a direct course to the vent outlet and thereby leave quiet, unventilated corners or pockets. They cannot sweep out strata of cold air which always form in such quiet areas. These ceiling diffusers serve a good purpose in cooling in warm weather, as such cool air tends to spread out over the otherwise quiet areas. A St. Louis high-school auditorium designed fourteen years ago uses such ceiling diffusers and the results are very unsatisfactory.

### AIR CURRENTS OF THE OPEN WINDOW

The admission of air through the windows produces air currents not at all understood by the average observer. An air stream entering a room, and more than ten degrees lower in temperature than that of the air in the room, does not diffuse and equalize with the room air but falls through it and forms a cold stratum on the floor. Smoke tests of such conditions make a striking picture.

Air at 33°F. entering a window raised 1 in., with a window-board deflector, strikes the rising hot air from the radiator but can not commingle and equalize; but this cold air breaks a hole through the hot air "curtain" and falls to the floor, very slightly tempered. The warm air rises to the ceiling and escapes if means are provided. The lowering of the upper sash of the window has the effect of permitting the escape of the undiluted warm air and thereby holding the cold and impure air at the breathing line.

The large vent or exhaust duct advocated by the New York Commission is exceedingly effective in removing the warm air which has risen directly upward from the radiators. Its principal office, therefore, is that of waste. Stratification can not be prevented by any kind of deflectors or diffusers where temperature differences of more than a very few degrees are involved.

Open-window ventilation is impossible where the outside temperature is below 50°F. There are no means of removing cold air from below the desk level except to force it out through vent openings placed near the floor or in the floor or to resort to the objectionable method of introducing warm air in small jets through the floor; warm air from above will not mix with the cold air of the room.

### THE NATURAL DIFFUSER

The introduction of warm or conditioned air into a school room is not a matter of choice of the engineer or of somebody's invention. It is a matter of adhering to the natural laws that govern the movements of air currents of varying temperatures.

From the foregoing it will be seen that warm air can not be introduced at or near the floor because of the rising dust and odors and because cold or cooler air will not go out at a higher point. Outgoing air should always be cooler than incoming air. This is necessary because the room must have heat losses, and the presence of a radiator in the room is a disturber of the circulation and has no valid function.

The natural and ideal location of the warm-air diffuser is near the ceiling, in the middle of one end of the room, with the vent near the floor level at the same end of the room. The warm, incoming air spreads out near the ceiling and sweeps the stratified warm air on to the farther end, constantly mixing with the room air below, due to the large contact through traveling the length of the room. The air is cooling by diffusion and by giving up heat to the walls and windows, so that upon striking the farther end the current turns down and moves back to the vent, the lower or return stratum being more than half the room height.

By this means the velocity of air motion in the lower six feet of the room is reduced to 10 to 15 ft. per minute. The writer has observed the swinging of all the window-shade cords in a room, yet the air motion at the desk level was not over 15 ft. per minute. The air comes through the diffuser with a velocity of 500 or 600 ft. per minute, which involves sufficient force to carry the upper stratum the entire length of the room, and to give full displacement at the farther end. Any cold air will always be swept on the level out at the vent grill.

The room is under a constant air pressure and the leakage through windows and doors will always be outward. The opening of a door into the corridor tends to destroy that pressure, and to increase the infiltration of cold air and dirt through the windows. It also leaves one end of the room without air motion. The opening of an outside window, with a calm outside, will merely permit the outflow of warm air. The opening of a window from the top will always result in outflow, though in a wind the flow may be in both directions.

Nothing is ever gained by opening a window at the top in cold weather. It is the proper means of cooling a room. A window can not be raised

any appreciable extent on a cold windy day, which is the usual day in St. Louis, in winter. As air motion must be under 25 ft. per minute to be agreeable, and a 10-mile wind, the yearly average, is 880 ft. a minute, it is apparent that the windows cannot be opened much if school is to keep.

### THE COST OF HEATING AND VENTILATION

The effect on the pocket-book with the finance department is exactly as it is with the individual. It is of first consideration in every step of school-building. It was the announcement that mechanical ventilation was costing so many millions more than the open-window method that caught the eye of school officers everywhere. It was a real test of how far they would go for a dollar! It was a mirage that tricked them into a vision of economical delight just ahead. But the picture has faded and we are back on the highway of science and common sense.

Many school officials who read this will not be able to understand how a complete heating and ventilating plant, with automatic control of temperature, humidity and air motion, and with air washers for removing dust and noxious gases and ozone, can be secured for the price of the plain radiator system without ventilation. This is being done in St. Louis, over and over again, and it is the present purpose to explain the more important steps taken to arrive at such results. No standard procedure can ever be laid down, because every job is a study in itself, so typical illustrative examples are given to point the way for those who are interested in improvement.

### BOILER PLANT

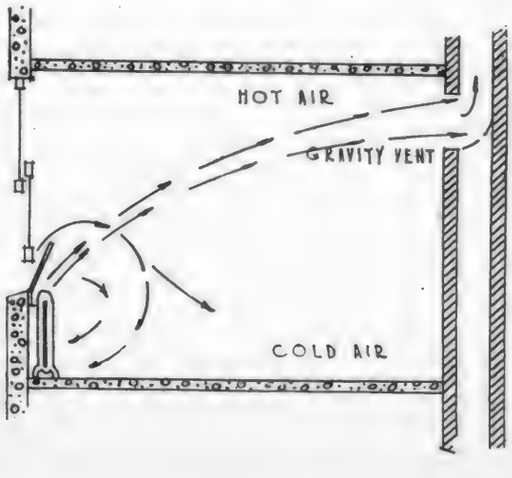
Economy must begin with the boiler. With recirculation and the improved window construction, heat losses have been cut to theoretical values. The use of waste heat of the smoke stack saves more than 20% of coal. The type of boiler is determined by the fact that engine-driven fans are indicated. That is, steam pressures are carried just sufficient to operate low-pressure steam engines in grade schools to take out enough energy to turn the fans and give the remaining heat to the heating system. The advantages to be derived from this source seem not to be appreciated. Electric current from the public service company would cost as much as the total coal bill for all purposes. The fans for a grade school of 1300 pupils use about 15 H.P. One fan is actually better than two for ventilating such a building. The steam necessary for such a grade-school plant in zero weather is not over 60 H.P. The plants, in recent installations, have one 100 H.P. steel return-tubular boiler, with a stoker for using the cheapest soft-coal screenings, burned smokelessly. There are installed in buildings erected ten years ago two 150 H.P. steel boilers and two fans and engines.

The small boiler now has as large an excess capacity as have the old plants, or as large as they formerly had before they were remodeled. It is very close to the fact to say that the size of the present plants are one-third of those of ten years ago for the same building sizes. The small individual room ducts of former days have been replaced by large trunk ducts with simplified housings that cost about one-third, at similar unit prices. The present bids of contractors on the new type are little more than half of the same prices for building of ten years ago.

### DIRECT AND INDIRECT RADIATION

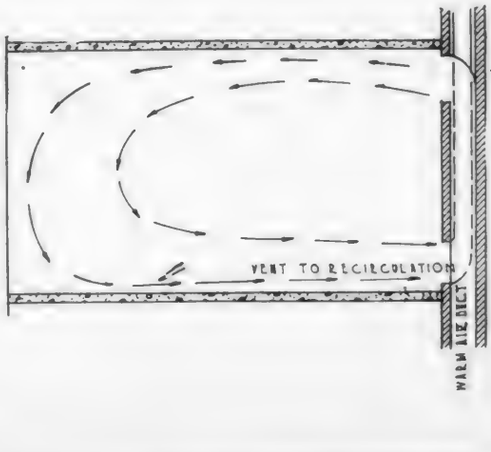
The statement is current that the indirect fan system must cost more than room radiation because fans, engines and indirect heating apparatus must be expensive. A careful comparison has been made on a typical school, and the cost of fan, engine, air washer, Vento heating coils and housing and ducts is almost exactly the same as that for the room radiation and the piping for same. It must be remembered that the central radiating plant is more than five times as effective as direct radiation and the piping system for it quite inexpensive. The central plant uses short, large pipe and it is all thoroughly insulated and not exposed to damage by occupants. This discussion does not involve the relative permanency of the two systems although it is but fair to say that the central plant is far more durable and less expensive to maintain.

*(Continued on Page 87)*




**(Left) Elevation Showing Air Movement With Open-Window Scheme**

**(Right) Elevation Showing Circulation With St. Louis System**



# Double Glass and What It Means

## A Discussion Showing How Large An Amount of Heat Can Be Conserved by This Method

IT seems passing strange that, with all the attention which recently has been devoted to the subject of heat conservation by means of house insulation, so little time has been spared to deal with the subject of heat loss through glass. Roughly, glass per square foot has about four times the loss of a common wall, either of ordinary frame or of 12-inch brick construction.

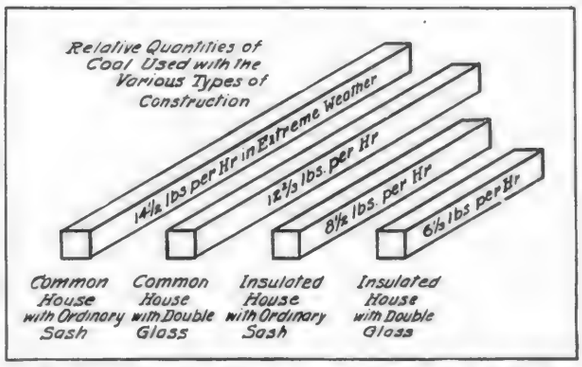

Relative Quantities of Coal Used with the Various Types of Construction
14½ lbs per Hr in Extreme Weather
12⅔ lbs. per Hr
8½ lbs. per Hr
6⅓ lbs per Hr
Common House with Ordinary Sash
Common House with Double Glass
Insulated House with Ordinary Sash
Insulated House with Double Glass

**Fig. 1. Graphic Comparison of Pounds of Coal Consumed per Hour of Extreme Weather for Various Constructions**

This being so, any insulation applied to the glass loss will be four times as desirable as applied to the wall, if such insulation can be effected at the same unit cost per square foot. Taking, for example, the calculations of an ordinary small house (which happen to be at hand) and analyzing these, it is found that the heat losses in B.T.U. divide up as follows:

CASE I.—LOSSES IN B.T.U.

| Wall | Glass | Ceiling | Leakage | Total |
|---|---|---|---|---|
| 28,158 | 33,968 | 32,413 | 22,322 | 116,861 |

The same house, when insulated with a standard make of insulation, shows revised figures in the same order as follows:—

CASE II.—LOSSES IN B.T.U.

| Wall | Glass | Ceiling | Leakage | Total |
|---|---|---|---|---|
| 7,460 | 33,968 | 4,286 | 22,322 | 68,036 |

In the ordinary house it can easily be seen that, if the total loss is taken as 100%, then the wall loss is about 24%, the glass 29%, the ceiling 28% and the leakage 19%, while, with an insulated house, the wall loss is about 11%, the glass 50%, the ceilings 06% and the leakage 33%.

This would make it seem even more necessary to stop the glass loss in an insulated house than in one not insulated, but this really is not so. The higher percentage constituting the glass loss in the insulated house is due to a lesser total loss; the B.T.U. loss is the same in both cases, as will be seen by referring to Case I and Case II.

### CLOSING OFF INFILTRATION UNDESIRABLE

Now after insulating a house the air change cannot be shut off without ill effects on the inmates, while the wall and ceiling loss has been reduced to the minimum. What remains? Only the glass.

Double windows (that is to say "storm windows") are not satisfactory owing to the fact that they reduce the ventilation to a point where cooking odors and house smells begin to accumulate to an offensive degree. A house entirely closed up with storm sash is noticeably less fresh than one without such protection.

There is surely no object in sealing up a house so tight that something must be opened for ventilation. This is only spending money to produce an undesirable result. But with the glass no ventilation is being received; in fact, a sheet of glass is about as air-proof as any substance known. Let us investigate a little further and see what double glass would mean in the house which has been previously considered.

### THE DOUBLE GLASS SUGGESTION

In the first place, with double glass the two sheets of glass are set in the sash about ¼-in. apart and must be set tightly to prevent dust and dirt working in between the two sheets. It, of course, is impossible to wash the inner surfaces of the two sheets and therefore, it is imperative that a good job be done in this respect.

With this accomplished it may be assumed that there will be a small film of still air held between the two sheets and the temperature of this air will be about midway between the inside and the outside temperatures. Thus, if there were a temperature of 70° F. in the room and zero outside, the air film would be about 35° F.

Therefore the heat loss on the inside sheet of glass would be only for a temperature difference of 35° F. instead of 70° F. The heat loss from the glass naturally is cut just in half.

### HEAT LOSSES WITH DOUBLE GLASS

This would make the heat losses in Case I as follows:—

CASE I.—LOSSES IN B.T.U.

| Wall | Glass | Ceiling | Leakage | Total |
|---|---|---|---|---|
| 28,158 | 16,984 | 32,413 | 22,232 | 99,787 |

and for Case II, similarly.

CASE II.—LOSSES IN B.T.U.

| Wall | Glass | Ceiling | Leakage | Total |
|---|---|---|---|---|
| 7,460 | 16,984 | 4,286 | 22,232 | 50,962 |

The summary now shows these heat losses:

| | B.T.U. |
|---|---|
| For the common house, with single glass. | 116,861 |
| For the same house, with double glass... | 99,787 |
| For the insulated house, with single glass | 68,036 |
| For the same house, with double glass... | 50,962 |

Taking the ordinary house as 100% loss, the use of double glass will reduce the loss to 86%, the use of insulation and single glass will reduce the loss to 59% and the combination of insulation and double glass will reduce the loss to 44% of the original loss. Coal bills would be about in equal proportion.

Assuming an annual coal bill of $150 for Case I, then this could be reduced to $129, $89 or $66 in the various combinations as noted. In Case I with double glass the saving of $31 would be sufficient to pay 6% on an investment of $500, and in Case II the saving of $23 would be sufficient to pay 6% on an investment of almost $400 or 12% on half these amounts which should amply cover the cost of double glazing.

## The Mechanical Ventilation of the St. Louis Schools

(*Continued from Page 85*)

### LOW COST OF PLANT WITH HIGH LABOR PRICES

The real test of the merit of the new heating design is seen in the continued low bidding on the new buildings. The prevailing requirement of a St. Louis grade-school is for 1200 to 1300 seats in class-rooms, two playrooms, two gymnasiums, assembly room for community meetings, faculty room, hygiene suite and the usual offices and store rooms. The volume is about one million cubic feet. Toilet rooms have direct radiation only. Community room, office and hygiene rooms have both direct and indirect. Heating and ventilating plants for such a building now cost about $38,000 to $40,000. Ten years ago a plant for the same building would have cost $55,000 to $60,000. Those plants costing $60,000 ten years ago would cost all of $90,000 to-day.

There is, therefore, fully $50,000 saved on each building, due to the new plant design. St. Louis is building not less than three new buildings of this class a year. This reduces the cost of the most complete plant with the dual systems in several rooms to less than 4 cents per cubic foot of whole building. It is $3.00 per pupil.

### FUEL COSTS GREATLY REDUCED

The original objective in making the new study of plant design was the reduction of fuel and other operating costs. The cost of fuel for the year for the Woodward School in 1924 was 135 tons at $3.60, or $486. For 1925 it was 150 tons at $3.80, or $570. Average $528. This is a pupil cost of 40½ cents per year. The cost for the Lincoln and Roosevelt are lower than that and several others are under 50 cents per pupil per year. The St. Louis School System in 1916 consumed 36,000 tons of coal. Since that date more school building has been done than ever before in a like period. Three large high schools and a junior high and fifteen grade schools, having not less than a total of 650 rooms and the high-school power plants have been added. The coal consumed in the year 1926 was about 38,000 tons. It may be said that the cost of heating and ventilating the whole of the 650 rooms added is net profit accruing from the improved plant design and such improvements as could conveniently be made to old plants.

## New Home Study Course

(*Continued from Page 82*)

**Work Problem S-7-13**

It is necessary frequently to loop a steam main around a beam. Detail O, Fig. S-7-4, illustrates the proper arrangement of fittings to overcome this obstacle. Detail P, same figure, shows how a dry return main may be looped around a door or other opening.

**Work Problem S-7-14**

### RADIATOR CONNECTIONS

Connections to radiators should always be made so that the main or riser or both may expand freely without straining the fittings at any point and at the same time drain the radiator properly and be free from water pockets. Many and varied conditions arise under which radiators must be installed. It is obviously possible to illustrate only those which may be classed as the more or less typical. Fig. S-7-5 shows four conditions of installation. In detail A, the radiator is supplied from an overhead main while return main is at the floor. Detail B shows a radiator with supply and return at the floor connected to risers located some distance from the radiator. Detail C shows similar connections to the risers near the radiator while detail D illustrates required piping arrangement where a radiator is supplied from a drop riser and with return at the floor line.

It should be observed that in each detail there are no "stiff" connections. The riser is free to move vertically and grade of pipes is ample, assuring positive drainage.

**Work Problem S-7-15**

*Lesson No. 23, the last of the steam heating section, to appear next month, will be devoted to the presentation of problems on design and inspection reports.*

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NEWS that a further grant of funds from the Millbank estate would enable the New York State Commission on Ventilation to renew its activities was taken by heating men to mean that the commission would attempt to complete its studies, which were the basis of its voluminous 1923 report. In fact, the statement was given out from the commission's headquarters that it was planned to conduct tests in at least two additional up-state schools, after which it was the intention to transfer operations back to schools in the metropolitan district. The commission, it was stated, fully realized that the experimental work carried out during the first period of its existence had not been brought to that point of completion and finality which it should have reached, due primarily to lack of funds and, in a measure, to the interruptions caused by the war.

A new light, however, is thrown on the situation by a statement appearing under the name of Thomas J. Duffield, executive secretary of the commission, which appears in *The American School Board Journal* for January. After referring to the opening of a new office in New York City "for the purpose of carrying forward a study of window-gravity ventilation and the furtherance of its application," Mr. Duffield continues:

"The work will consist in accumulating data in regard to systems of window ventilation actually in operation, in studying the conditions essential for this method and in answering requests for assistance of school authorities, all over the country, who are interested in this procedure. The commission proposes also to study legislation in the various States and to consider possible standards of ventilation which might be recommended as substitutes for the present requirements, based on discredited theories."

If the foregoing correctly expresses the mind of the commission, it is evident that that body is about to take on all the attributes and functions of a lobby to "put over" the open window.

As matters stand at the moment, there seems to be a division of sentiment as to whether it is wiser to let the open-window agitation run its course or whether the movement should continue to be actively combated. In view of this new development, it would seem that the industry has no option in the matter but must continue to wage the battle for controlled ventilation until the open-window fallacy is finally scotched. Certainly, nothing more important could face the ventilating branch of the industry during the period immediately ahead.

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THE fact that the winning design in the schoolhouse ventilation competition, recently conducted in these columns, was of the fan and duct type is interesting, but not necessarily significant. When it came to judging the solutions submitted, some basis had to be used as a standard for comparison. It was recognized that the conditions should be as broad as possible but, in any event, must include the items of air supply and distribution, air temperature, humidity and freedom from dust and odors. After careful consideration, it was decided to take the requirements as set forth in the A. S. H. V. E. *Guide* for 1926-1927, in the section compiled by Perry West under the heading of "Ventilation."

Several of the designs in which unit ventilation was adopted fulfilled the required conditions from the standpoint of air supply and distribution, but contained no provision for humidity or dust removal, or both. In the tabulation of the first ten designs, shown on another page, the extent to which any one solution failed to meet the conditions set forth will be seen at a glance. It is a noteworthy fact that all of the contestants based their calculations on the air supply figure of 30 cu. ft. per minute per person.

So interesting and varied were the solutions offered that it is our purpose to publish, not only the winning designs, but also some of the others which displayed unusual novelty or ingenuity.

## American Society of Heating and Ventilating Engineers

# Heating Engineers Hail New Era in Field of Equipment and Design

### Significance of Latest Appliances and Methods Shares Honors with Recent Developments in the Window Ventilation Movement

A NEW radiator design about to be placed on the market, data on the latest types of dry air filters, the development of the invisible radiator, a new method of dehumidification, and a modified vapor system of steam heating, involving an application of a constant differential to temperature control, occupied the limelight at the annual meeting of the American Society of Heating and Ventilating Engineers, held in St. Louis, Mo., January 26-28, with headquarters at the Hotel Statler. The place accorded them on the program and the interest they aroused constituted an eloquent tribute to the recent rapid advances of the art.

**Dean F. Paul Anderson,**
President, American Society of Heating and Ventilating Engineers

One entire session was devoted to the much-discussed theory of window ventilation for schoolrooms, at which a representative of the Wisconsin State Instruction Department, a nationally-known architect and an official of the Ohio State School Board presented impressive evidence of the fallacy, especially on the basis of cost, of the open-window method of ventilation. In two of the papers plans were presented of school buildings in which the open-window method had been adopted for purposes of test. In each case, the figures, both for design and operation, demonstrated the higher cost of the open-window over mechanical ventilation.

Another session was devoted to the work accomplished during the past year by the society's Research Laboratory. Prominent among the tests under way, on which data were presented, are those dealing with air infiltration through windows and walls, tests on heat losses through building materials made with the society's heat meter, and steam flow through pipe risers.

Among the important actions taken by the society was the adoption of a code for testing radiators. This code will be used in future tests conducted at the Research Laboratory under the general direction of the Advisory Committee on Radiation.

All previous records for attendance went by the board when it was announced that over 400 members and guests were registered at the meeting. Every session was well attended. At the session devoted to school ventilation the attendance overflowed the meeting room and required the opening of the connecting doors to seat all who crowded in.

Mild weather prevailed throughout the meeting, the outdoor temperature at no time falling below 20° F. Most of the time it was above the freezing point.

## Opening Session, January 26

President William H. Driscoll opened the meeting in the Adam Room of the Hotel Statler, Wednesday morning. Before this session adjourned, it was announced that there were 325 members and guests present, making the meeting the largest the society has ever held.

The welcome of St. Louis was extended by E. B. Langenberg, chairman of the local entertainment committee. A warm tribute was paid to John Cassell, chief engineer of the Philadelphia Board of Education, when President Driscoll announced that Mr. Cassell had been honored by the Philadelphia Society of Municipal Engineers with a gold medal commemorative of his 36 years of service in that office. The fact that he had foregone the bestowal of his honors to attend the society's meeting made a hit with the gathering which greeted him tumultuously when he arose to acknowledge the chairman's greetings.

An innovation which was reflected early in the meeting was the scheduling of committee and other reports at different sessions so that no one session was devoted entirely to routine business. For that reason the president's address was deferred to the afternoon.

Secretary A. V. Hutchinson read the report of the council. In referring to the proposed open-window ventilation tests in Rochester, the report stated that "another activity resulted from the invitation of the Board of Education of Rochester to co-operate in heating and ventilating tests in schools of that city and, with Perry West as chairman and W. H. Carrier as vice-chairman, proposals have been submitted for the remodeling of existing systems to conform more closely to modern practice, and tentative recommendations were made for the interpretation of the results obtained during the contemplated two-year test."

The report also stated that "upon invitation of the American Engineering Standards Committee the society assumed sponsorship for exhaust and ventilating codes and also is represented by D. S. Boyden and A. A. Adler on a sectional committee working on symbols and abbreviations and Standards for Drawings and Drafting-Room Practice."

During the year 67 members were dropped for non-payment of dues. Other losses were 17 who failed to qualify for membership and 55 who resigned. A total of 206 names was presented for membership.

A. A. Adler, continued the report, has been authorized to work in co-operation with Chairman L. A. Harding of the Code Committee, to put the Code of Minimum Requirements in final form for printing at the earliest possible date.

A new *Guide* Publication Committee has been appointed, with Perry West as editor-in-chief, and with Messrs. Carrier and Haynes as vice-chairmen, with power to organize a committee of such scope as may be found necessary.

Secretary Hutchinson, in his secretary's report, announced a slight gain in membership during the year. As in former years the profits from the publication of the *Journal* and the *Guide* have been added to the Research Laboratory and other funds.

For the Committee on Increase in Membership, C. V. Haynes reported that the society's membership is now 2,098, as against 1,887 last year.

Dr. C. W. Brabbée presented the first paper of the meeting, which supplemented a paper presented at the society's Buffalo meeting last year, on the subject of "Heating Effect of Radiators."

In the discussion following Dr. Brabbée's presentation, one of the questions raised was as to the type of radiators used with which such satisfactory results were obtained. Other points referred to the floor temperature, temperature rise between the floor and ceiling, temperatures in other parts of the room, height and width of the radiators, effect of increasing the furnishings of the rooms, effect of radiant heat on the testing thermometer and tests of the humidity.

Dr. Brabbée stated that a description of the type of radiator used would appear later. Floor coverings, he said, made a marked difference with temperatures at the floor level and for this reason the thermometer readings were taken 18 in. above the floor. As no temperature readings were taken at the floor, the temperature difference between the floor and ceiling could only be given as shown in the charts.

Dr. Brabbée also stated that the thermometers were located as shown in the diagrams, as this was considered a fair location to indicate average conditions. Radiator A was a 32-in. 4-col. unit and Radiator B 23 in. high and 2¾ in. deep.

Furnishings, or the lack of them, he said, seemed to make little difference, while the radiant heat on the thermometer was no more than it would be on a person standing in the same position. The relative humidity was about 35% in all cases.

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New finishes for radiators being announced from time to time, it is but natural that tests be made periodically to determine the effect of these finishes upon the emission of heat from radiators.

Professor W. A. Severns, of the department of mechanical engineering, University of Illinois, presented a paper describing the equipment and methods used to determine the relative values of three applied finishes and of the bare iron as it comes from the foundry. This paper supplements an article written by Professor Severns for THE HEATING AND VENTILATING MAGAZINE and published in February, 1925.

## Comparative Tests of Radiator Finishes

In his paper, Professor Severns outlined the problem as that of determining the relative emissivity of radiant heat from surfaces covered with different paints or finishes. He described the test set-up of drums used by Professor V. S. Day in developing the emissivity of heat from various surfaces and presented the data obtained in this way.

A second test was then run, using conventional cast-iron radiators instead of the cylindrical surfaces and Professor Severns concluded his paper with observations covering his derived data.

Discussion of this paper brought out the interesting points that a bright tin surface is a good heat insulator and that dust on the surface seems to make but little, if any, difference in the heat transmitted. The percentage to be added to the estimated radiation, if it is to be painted with gold or aluminum bronze, is about 10%. This must be modified, however, in accordance with the type of radiation being considered, owing to the fact that when a one-column radiator is painted, practically the whole surface is covered, while, with a three- or four-column radiator, only the portion of the surface visible to the eye is painted. For this reason the loss in efficiency will be greatest in the thinner types of radiation, sometimes requiring an allowance of as high as 25%.

With three- or four-column types, owing to the comparatively small portions painted, the required allowance would be less than 10%.

In connection with the painting of radiators by the spraying process, it was pointed out that the vehicle used for the paint would be the determining factor used in heat emission, rather than the process of application.

The continued lack of a universally used method of determining chimney characteristics for particular boiler installations led to the presentation of a paper on this subject by R. V. Frost, of Norristown, Pa.

## A Rational Method for Determining Sizes of Chimneys for Heating Boilers

Mr. Frost stated that "Chimney troubles on heating installations are so common that they form, without doubt, the most annoying and costly trouble with which the industry has to contend. Between the contractor and the owner, they are the basis for the majority of disputes that are carried to the courts."

He illustrated the futility of attempting to determine chimney sizes by means of tables now in use, by taking as an example a typical chart which was designed to provide a chimney selection on the single factor of output capacity of the boiler, and called attention to the fact that this method must fall short of the ideal, inasmuch as there are some 25 variable factors to be given consideration in designing the stacks for a large power development. Mr. Frost paid a tribute to the handling of this subject in the power field by J. G. Mingle and stated that his method was based on similar procedure, using, however, the variables found in heating-boiler practice.

Taking advantage of a set-up for boiler tests in his laboratory, Mr. Frost equipped the stack with thermo-couples and, from the data obtained with them, was able to prepare a table of average stack temperatures for corresponding temperatures at the boiler outlet, and upon calculation and comparison with the draft intensities that were obtained in the tests, it was found that the average temperatures selected checked very closely with the theoretical temperatures.

"The next problem," said Mr. Frost, "was to determine the gas velocities in the stack for various rates of fuel consumption and here it was necessary to devise a new method. After some experimentation the discovery was made that by opening the cleanout doors on the boiler wide open for a period of five seconds, a slug of cold air was admitted which passed up the stack with the rapidity of the gases flowing, and that the thermo-couples responded so quickly to the passage of the cold air that it was easy to make a very accurate determination of the velocity of the gas flow.

"With the data on average stack temperatures and the velocities of gas flow so obtained, an adaptation was made of the information in Mingle's volume to the requirements of chimneys for heating boilers and to a set-up in a form convenient to handle."

Tables were presented giving the results of this research. Mr. Frost referred to the fact that these tables generally will require more published data on boiler performance than the majority of makers now give, but as there is now a very evident tendency on the part of the boiler makers to use these data for the good of the industry, several having in whole or in part already done so, there are very good prospects for their wide application in the near future.

NEW OFFICERS

For the tellers C. A. Pickett stated that 594 ballots had been cast, with the following results:

President, Dean F. Paul Anderson, University of Kentucky, Lexington, Ky.

First vice-president, Professor A. C. Willard, of the University of Illinois, Urbana, Ill.

Second vice-president, Thornton Lewis, Philadelphia, Pa.

Treasurer, Walter E. Gillham, Kansas City, Mo.

Members of council: (three years), William T. Jones, Boston; John Howatt, Chicago; Charles V. Haynes, Philadelphia; and Willis H. Carrier, Newark, N. J.; (two years) H. Lee Moore, Pittsburgh; James F. Macintire, Detroit; Everett B. Langenberg, St. Louis; and J. J. Kissick, Cleveland; (one year) Howard H. Fielding, Denver; Professor Frank B. Rowley, University of Minnesota, Minneapolis, Minn.; Harry H. Angus, Kingston, Ont.; and Roswell Farnham, Buffalo.

Members of the Committee on Research: Philip Drinker, Boston; Samuel R. Lewis, Chicago; F. D. Mensing, Philadelphia; W. A. Rowe, Detroit; and Professor A. C. Willard, University of Illinois, Urbana, Ill.

## Smoke Abatement Work in St. Louis

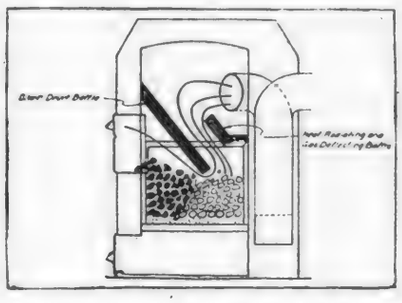
In a paper on "Smoke Abatement Work in St. Louis," C. G. Buder told of the work of the Citizens' Smoke Abatement League of St. Louis in launching the most comprehensive campaign ever attempted in St. Louis for the reduction of the smoke nuisance. The nature of the problem, he said, could be better understood when it was considered that of all the solid fuel burned in the city 95% or 8,000,000 tons was Illinois soft coal.

He submitted a baffle design which can be applied to furnaces already installed. This device will automatically consume the smoke except for short intervals during stoking periods. Many installations in St. Louis are using soft coal where the apparatus has not been designed for this fuel, making the problem an acute one in that locality.

Mr. Buder stated that the most satisfactory method of firing with this equipment is by the familiar coking method. In answer to a question he stated that the baffles are made of cast-iron, also of carborundum and tiles of various descriptions. The fact that the furnace temperatures run about 1800°F. make it amply safe to use cast-iron for this purpose.

In response to another inquiry he stated that the smoke ordinance now in effect in St. Louis is so drastic that, if strictly enforced, new equipment would be necessary in the great majority of cases.

Reginald Pelham Bolton brought out the fact that combined with the smoke problem is the matter of dust which, according to his tests in connection



**Smoke-Consuming Baffle Device Applied to Existing Furnaces in St. Louis**

with power plant operation, amounted to 1½% of all the fuel burned for either hard or soft coal, and went as high as 2% under peak loads.

Mr. Buder stated that both the furnace efficiency and the length of the firing periods are increased through the use of the baffles described.

For the Finance Committee, Chairman Thornton Lewis presented figures showing that the net profits from the society's publications had increased from $7,872, in 1925, to $11,000, in 1926. The *Guide* profits paid over to the Research Laboratory Fund had risen from $3,419, in 1925, to $4,401 in 1926. In 1925, the income from members' dues amounted to $24,000, while, in 1926, the figures came to $28,000. Of this amount $3,200 was represented by initiation fees.

## Afternoon Session, January 26

Before proceeding with the regular program, two representatives of the local branch of the American Institute of Mining Engineers were introduced. Mr. Thatcher made an earnest plea for the amalgamation of all the engineering societies of the country into one body. With such an organization, he declared, the engineers could exert a combined influence more commensurate with the position they should occupy in the affairs of the nation.

PRESIDENT'S ADDRESS

President Driscoll, in his address, offered for thought some suggestions for the welfare of the society which, he said, reflected the viewpoints of a considerable portion of the membership. He stated that the society, like all other organizations, had to pass through certain difficulties and dangers. One of these is occasioned by the growth in membership which has brought in a number of members having only a superficial interest in the society. This growth has also brought about an increase in the expenses of administration, and he cited the comparative costs of previous and recent meetings of the society, which showed a large increased expense.

The reflection of this increased expense is shown in the higher dues paid in recent years which, in some cases, have become a real burden. President Driscoll felt that the dues should be proportional to the society's technical output from which the members benefit.

As a possible means of reducing the annual membership expense, President Driscoll stated that it might be possible to arrange a chapter refund so that chapter members would not be required to pay chapter dues. He tentatively proposed the division of the society's organization into (a) business administration; (b) publications and (c) department of technical activities. Under the department of technical activities he spoke of the possibility of carrying on research investigations at various universities as a substitute for the work at the society's Research Laboratory.

He brought up the point that a concerted effort could be made in the research work to complete certain studies and promulgate the results with the endorsement of the society and he mentioned particularly the matter of boiler ratings.

At his suggestion it was voted that the council be authorized to appoint a committee to study the problems involved and report at the next semi-annual meeting.

Three papers were presented at this session on the general subject of air filters, one by H. C. Murphy, on "Design and Application of Oil-Coated Air Filters," one by H. G. Tufty and E. Mathis on "Simple Method of Testing Air Filters," and the third by Professor F. B. Rowley on "Report of Committee on Code for Testing Air Filters."

The ensuing discussion centered around the subject of the oil used in connection with such filters, the danger from fire and the possibility of objectionable odors. Mr. Murphy stated that the oils used for this work were carefully selected by the manufacturers and treated so as to be odorless and to have a flash point considerably above 120°F., which is the limit set by the Underwriters. All parts of the oil filters are made absolutely fire-proof and Mr. Murphy did not feel that there was the least fire hazard in connection with such equipment.

Lee Nusbaum then presented a paper on "Insulating a Residence."

## Insulation of a Private House

This paper discusses the hollow-tile house built in Germantown, near Philadelphia, in 1922, and insulated with a 1½-in. thickness of cork, placed on the inside of the wall surfaces. On top of this cork, ¾-in. strips were placed and then the lath and plaster applied.

Some very interesting results were attained by this insulation among which are a saving in fuel (which the author believes is about 62%) and the maintenance of a much higher humidity in the house during the winter.

The author also states that the heat loss in the ordinary house for windows and doors will be only about 15% to 30% while, in an insulated house, this figure will go up to 50% or 60%, owing to the reduction in heat losses through the wall.

Mr. Nusbaum included the following figures on the conductivity of insulating materials based, with one exception, on tests made by the U S. Bureau of Standards. In the case of the Celotex figures the test was made by George F. Gebhardt.

TABLE OF CONDUCTIVITY VALUES FOR INSULATING MATERIALS

| Material | Density Lbs. per Cu. Ft. | Conductivity B. T. U. per Sq. Ft. per Inch Thickness per Deg. F. per Hour | Remarks |
|---|---|---|---|
| Corkboard | 9.98 | 0.302 | Commercial destiny pure corkboard |
| Cabot's quilt | 15.6 | 0.319 | Eel grass enclosed in burlap |
| Fibrofelt | 11.24 | 0.328 | Felted vegetable fibres, flexible |
| Flaxlinum | 11.24 | 0.328 | Felted vegetable fibres, semi-rigid |
| Celotex | 16.45 | 0.33 | |
| Insulex | 18.1 | 0.564 | Light weight material |
| Insulex | 29.4 | 0.900 | More dense material |
| Asbestos mill board | 60.5 | 0.843 | Pressed asbestos moderately flexible |

In the discussion various speakers propounded views at variance with the conclusions reached by the author. Among other things it was claimed that the comparatively high humidity in the house was caused by the cork-board eliminating cold wall surfaces on which the moisture could condense. Another view expressed was that the humidity was caused by the waterproofing effect which inadvertently was obtained by the use of cork insulation.

Mr. Ashenhurst suggested that the society make a ruling on how much reduction should be allowed in the radiation for an insulated house. The suggestion was also advanced that, owing to higher ceiling temperatures, the insulation for the ceilings of rooms and the roof should be made twice as thick as for the side walls. It was also suggested that the steam may have been turned off at the time of the test, owing to the high outside temperature.

Another point was that the house was weather-stripped and that this would reduce the infiltration on the insulated house. It was also stated that homes could be made too tight, as one to two air changes per hour were required for reasonable ventilation. It was thought that the proportion of oil to coal should approximate 150 gal. to a ton.

In response to a request for information concerning the use of granulated cork in place of corkboard, Mr. Nusbaum stated that insulating costs had to be kept within bounds and that 4 in. of cork on the ceiling and roof would appear to be excessive, especially when so little temperature difference between the floor and ceiling was obtained in an insulated house.

He also stated that steam was on the radiators when the tests were made and that the use of granulated cork, while less in cost, would introduce difficulties in construction on account of the necessity of holding the particles in position.

In regard to the oil ratio, Mr. Nusbaum said that the difference might be due somewhat to the fact that with the oil burner the day time temperature was maintained all night, whereas, with coal, the thermostat automatically reduced the temperature at night.

The concluding paper at the afternoon session was on "Design and Operation of Hotel Heating and Ventilating Systems," by Benjamin Natkin.

## Thursday Morning Session, January 27

Under the designation of "Schoolhouse Ventilating Session," the papers presented at the Thursday morning meeting all had a bearing on the open-window ventilation agitation.

In the absence of Perry West, chairman of the Rochester Committee, which was appointed to arrange for some comparative tests of school buildings in Rochester, N. Y., of both the open-window and mechanical ventilation types, his report was presented by Samuel R. Lewis. The report told how the scope of the investigation had broadened until five other scientific bodies had become associated with the project. After the preliminary work had been well accomplished and the two schools selected, the report told how the investigation had been brought to a standstill, at least temporarily, through the failure of the associated bodies to agree upon a basis of interpreting the results. It was recognized, however, by ali that there should be a dual basis for conducting the tests, one having reference to the physical qualities of the air and the other to such items as illness, etc.

While the various interested bodies are still deadlocked on the matter of establishing a basis of interpretation, there is a prospect that an agreement may be reached by March 1. If not, concluded the report, it will be too late to start any tests this year and the investigation, in that case, would have to go over to the next heating season.

The presence of James H. Davis, formerly of the American Radiator Company, and of Professor James D. Hoffman, of Purdue University, was noted by President Driscoll, who called upon them both and they arose to the plaudits of the assemblage.

By this time the hall was filled to overflowing in anticipation of the important papers on the program. H. W. Schmidt, supervisor of buildings of the Wisconsin State Department of Public Instruction, was the first speaker, his subject being "Practical Aspects of Heating and Ventilation of School Houses."

Mr. Schmidt devoted most of his allotted time to a discussion of his paper and held the close attention of the gathering while he gave first-hand evidence of the conditions as they are actually encountered in schoolhouse ventilating work in that State.

## Practical Aspects of Heating and Ventilation of School Houses

One of the most interesting papers presented and one of the most valuable contributions to the schoolroom air-conditioning controversy was read by H. W. Schmidt, supervisor of buildings, Department of Public Instruction, State of Wisconsin. Mr. Schmidt's paper was of particular value because of the fact that he is not a member of the society and because, having inspected and checked up the heating and ventilation of over 400 schools, he is an avowed exponent of controlled air-conditioning.

### SOME PRACTICAL ASPECTS OF HEATING AND VENTILATING SCHOOLHOUSES

Mr. Schmidt first expressed his opinion that "the most important factor which lies at the foundation of the whole matter is that of controlling both heat and air influx so as to produce a condition which is conducive to the greatest comfort of the occupants of a schoolroom."

"*It is not a question of simulating out-door conditions at all*," said Mr. Schmidt, "though it would appear as if in some instance this seems to be the major premise, wide open-windows, etc. There are very few days indeed when out-door conditions are such as to produce maximum comfort, especially when one considers the circumstances under which the individuals are working." Continuing, Mr. Schmidt said:

"The worst problems confronting the school man as well as the heating and ventilating engineer are those in connection with the smaller schools and the rural one- and two-room buildings. The United States Bureau of Education, 1922

Report, credits the rural districts with 186,532 buildings while cities of 2,500 or over are credited with 2,891 *systems*. The actual number of buildings is not available. The number of children involved in these rural and small districts is nearly equal to the number enrolled in city systems, over 10,000,000. The whole number of pupils reported in the above report is 26,458,655, including both public and private schools. When those not reporting are included it is clear from these figures that the welfare of nearly *one-third of the population of our country* is involved.

Sometimes very rigid economy must be practiced as a real necessity, and under these conditions gravity jobs are oftentimes essential and fan jobs are few and far between. But even gravity jobs are not immune from tampering and 100 per cent recirculating with no fresh air at all is quite common as well as pipeless furnaces, though both are commonly prohibited both by good judgment and sometimes regulations. Experience among the officials of these smaller schools has shown that the need for a reasonable amount of fresh air is either not understood or denied. Only recently a school board official's attention was called to the extremely bad condition existing in the school-rooms of his district and the reply was, "They ain't any of them kids sick and I guess they won't never be. I never had no ventilation when I went to school." Arguments had no effect and on calling his attention to his new chicken house which had three large ventilating hoods on the roof, he said, "Well, *them* chickens lay eggs." There is the whole story. We are confronted with a condition, not a theory.

It may have dawned on you by this time that I am defending codes governing heating and ventilating. I am. I have seen enough poor jobs to make me a believer in some sort of authoritative standards. Standards will be changed from time to time as evidence is gathered that new conditions or devices produce results which are more satisfactory—such is progress. In the meantime it becomes necessary, as a practical matter, to set up certain standards to govern heating and ventilating installations in spite of the fact that certain individuals argue to the contrary.

Now I want to call your attention to the fact that gravity window ventilation is not even mentioned in the Wisconsin code, nor is it prohibited by inference. In spite of statements to the contrary, the Wisconsin code is not inflexible and I believe others are in the same class.

Any order may be changed or modified if reasonable arguments are presented substantiating the proposed changes. I am making this statement at this time to show present-day standards are not necessarily fixed nor arbitrary and that a code, governing in general, may not be "pernicious," in its application. A code *does give better heating and ventilating lay-outs, as a matter of practice, than if no standards were set up.* Field observation proves this.

"The unit room ventilation has also received its share of attention at our hands both as regards installation and operation. I shall have to confess that in practice, well installed units have proved perfectly satisfactory and have delivered their predetermined volume of air at proper temperature. The factor of noise is in most cases negligible, in fact I have seen, or rather heard, plenum systems much noisier than the room units. Manual room control of both air volume and temperature is, as a rule, unsatisfactory as the teacher is busy in other directions and forgets all about it. On the other hand centralized janitorial control must also be watched, as I have often found the units run at much reduced speeds to save fuel and operating expense (some direct radiation was installed). Automatic control of these units should be insisted upon, as well as provisions for air filters.

## Isn't This Typical?

**"Experience among the officials of the smaller schools has shown that the need for a reasonable amount of fresh air is either not understood or denied. Only recently a school board official's attention was called to the extremely bad condition existing in the school-rooms of his district and the reply was, "They ain't any of them kids sick and I guess they won't never be. I never had no ventilation when I went to school." Arguments had no effect and on calling his attention to his new chicken house which had three large ventilating hoods on the roof, he said, "Well, them chickens lay eggs."**

"In conclusion, then, I want to say that:

"The major problem has to do with the installations and design of the smaller schools and especially the one- and two-room rural schools which are sorely in need of efficient and moderately-priced installations. They rarely get expert advice or service and the county hardware dealer usually gets the job.

"The matter of consistent operation is also of great importance and here again an educational campaign should be waged. To shut down a portion of a plant, which has been designed to produce certain conditions in the heating or air supply, in order to save a few dollars—if it does really save— is indefensible. Better had it been omitted in the first instance. If the job has been properly installed in the first place and devices are provided to condition the air supply, then they should be operated and the matter should be insisted upon to the fullest. Proper air conditioning and the devices used to produce it are inseparable. A deviation promotes both inefficiency and improper results.

"The matter of interlocking devices, highly automatic operation and so-called fool-proofing of devices has also been brought to attention in an attempt to produce more consistent operation, etc. I may be pardoned in saying that, 'There ain't any such animal.' Ninety-nine of these devices can be juggled and put out of business. I have seen 'jumpers' applied, dampers chained and nailed in place, belts removed and what not, all to shut down some fancied high-operating-cost mechanism. An educational campaign is the only 'saving' factor in this situation."

## Modern Schoolhouse Heating and Ventilation

In a paper on "Modern Schoolhouse Heating and Ventilation," William B. Ittner, architect for the St. Louis schools, presented a masterly portrayal of the factors involved in modern ventilation. His address was supplemented by data on a window ventilation system installed in one of the buildings of a school group in Greenfield, Ohio, which bore out the points which have been made as to the increased building cost necessary with window ventilation.

The position of an internationally famous school architect in the matter of air-conditioning was exemplified in the paper by William B. Ittner, consulting architect of the St. Louis school board. Mr. Ittner is known as one of the foremost school architects in the United States, having designed notable schools in many States. In addition to being a past executive of The American Institute of Architects, Mr. Ittner was honored by being elected a fellow of the Institute and also received a medal from his local chapter for his outstanding work in this field. Consequently, his paper was looked forward to with a great deal of interest.

### SCHOOL VENTILATION FROM THE VIEWPOINT OF THE SCHOOL ARCHITECT

After briefly reviewing the history of ventilation as applied to schools, Mr. Ittner said: "Engineering and not medical science, then, is to be credited with the discovery and modifications of discrepancies in early types of mechanical ventilation systems. The modifications, it will be noted, have been chiefly in the direction of regulation downward of excessive temperatures and in the direction of precise control. Air-conditioning was a development incidental to local demands because of odors, dust, aridity, or other objectionable features.

"The fundamental engineering problem has been to secure suitable temperatures independent of prevailing outdoor conditions, and air movement without draft. Controlled methods have everywhere superseded haphazard experiment. Whatever the agreed optimum for health, the architect and engineer can supply it. Any air velocity; any temperature range; constancy or variability in heat, humidity, or other conditions; aggregate or unit control; whatever the health specifications, good design plus intelligent operation of mechanical systems can achieve it."

Mr. Ittner's attitude toward the open window controversy is best expressed in the following pithy observation:

"Mechanical ventilation is controlled ventilation. Window ventilation is uncontrolled ventilation. Every installation is a new problem for engineering skill. Any formula is a fallacy. The open window formula was tried and found wanting years ago and, contrary to its popular propaganda, the complexities and costs of its apparatus and management are far in excess of those of the mechanical systems it seeks to supersede."

And again:

"Architects offer no formulae for school ventilation. They are open-minded enough on the one hand to dispense with mechanical ventilation in isolated situations and exceptional instances where the air is pure and noise or odors offer no problem, and on the other to provide the utmost limit of air treatment and transport where crowded cities, manufacturing process, or physiological requirement call for it. The general trend favors year-round air conditioning with cooling in summer and heating in winter rather than return to earlier, uncontrolled methods."

Probably the most interesting part of Mr. Ittner's paper was his presentation of actual facts and figures giving comparative costs of a typical school building equipped for window ventilation and again for one with complete control of mechanical air-conditioning. In leading up to the presentation of these figures, Mr. Ittner said:

"Costs of ventilation equipment are important considerations, but costs are relative. If cost is commensurate with service, or if the child's health is in the balance, we can only require that the outlay be consistent. Engineering standards make no virtue of the mere fact of low expenditure. It is economy plus efficiency which counts. It is somewhat beside the mark to compare costs between an efficient mechanical system with fixed load, capable of precise, central, automatic control, independent of outside climatic conditions, with window gravity ventilation, never measurable, never predictable, and never centrally operated.

This is especially true when the provision of open windows and gravity exhaust for class-rooms does not obviate the necessity of independent mechanical systems for air-removal and air-renewal in toilets, laboratories, kitchens, and cafeterias. If air filters are utilized in connection with open windows, comparisons would be still more misleading.

"A specific cost comparison between mechanical and window ventilation systems as applicable to a modern elementary school plant at Greenfield, Ohio, is set forth in Table I. On February 20, 1925, an eight hour test of the heating and ventilating system in this building was carried on from 8 o'clock in the morning till 4 o'clock in the afternoon. The building has a capacity of 1,250 pupils and is organized on the platoon plan.

"The average outside temperature was 22°F. Room temperatures were maintained in all the rooms throughout the test, ranging from 68° to 70° F., making an average of 69°. The outside relative humidity was 31. The relative humidity in the class rooms was 40 to 43, an average of 41.5. The average velocity of the air entering the rooms through the diffusers was 269 ft. per minute and the class room air chambers were 8.25 per hour. This represents about a 100 per cent performance.

"A typical class room accommodating 40 pupils under window ventilation would require 12,480 cu. ft., which represents an excess of 36.2 per cent over the 9,152 cu. ft. content, which is ample under mechanical ventilation. The window area required is 192 sq. ft. under window ventilation, or 36.2 per cent more than the 141 sq. ft. found requisite under the mechanical system. The air supply under window ventilation shows the ratio of 800: 1,200, or one-third less than the mechanical load.

"Roughly, then, the expenditures under the self-styled 'natural' system of ventilation is one-third more and the air supply one-third less than that assured under a controlled system. This takes no account of the absolute failure of open windows as ventilators if climatic conditions or location are not favorable and the fact that radiation under the window gravity plan will average 426 1/3 sq. ft. on the three floors of the Greenfield Elementary School as against 123 1/3 sq. ft. under the mechanical plan. This represents an excess of about 240 per cent in radiation.

"The dollars and cents costs of excess fuel for maintenance would depend of course upon seasonal requirement and the efficiency of the maintenance engineer. It would run into a large sum annually. The total building results under window ventilation show an excess in cubic contents of 122,250 cu. ft., or practically 10%. The cost per pupil would be $22.65 in excess of the mechanical installation, or 9.25%, and the total additional cost of building involved in the problematical window arrangement would be $28,316.98, or about 10%. *Apparently much proof needs to be forthcoming to substantiate the statements of window-gravity ventilation propagandists that the State of New York is wasting millions every year on mechanical ventilation.*

"Central control of ventilation is essential for school efficiency. Hygienic standards now prevail instead of individual notions. Those standards are not static. They are open to revision. School ventilation requirements represent no extremes of air-conditioning that are at all formidable to architect or engineer. Efficiency within the full range of limits of operation are achieved in all climates and at a minimum cost for the conditions submitted, and performance tests prove the reliability of the ventilation system under competent management. These matters and not controversies pertaining to standardization are the function of the school architect."

*TABLE I—Comparing cost relationships between mechanical and window ventilation in typical class room unit of forty pupils.*

| *Class Room Unit* | *Mechanical Ventilation* | *Window Ventilation* | *Percentage Gain or Loss* |
|---|---|---|---|
| Cubic Content ..... | 22x32x13=9,152′ | 24x40x13=12,480′ | + 36.2% |
| Air Supplied C. F... | 1,200 | 800 | — 33.3% |
| Window Area-Glass.. | 141 sq. ft. | 192 sq. ft. | + 36.2% |
| Amt. of Radiation (Average 3 Floors) | 123.33 sq. ft. | 426.33 sq. ft. | +240.% |
| Total Bldg. Results: | | | |
| Cubic Content ..... | 1,019,843 | 1,127,253 | + 122,250 cu. ft. or 9.85% |
| Cost per Pupil ..... | $244.76 | $267.41 | + $22.65, 9.25% |
| Total Bldg. Cost .... | $305,952.90 | $334,269.88 | + $28,316.98 or 9.25% |

## What Layman Thinks About Schoolroom Ventilation

W. R. McCornack, of Cleveland, O., in a paper on "What the Layman Thinks About Schoolroom Ventilation," told how the recent history of mechanical ventilation had affected the health departments in Ohio and how they were agitating, in connection with the revision of the Ohio Building Code, for action to do away entirely with any provision for mechanical ventilation. This code, he said, is now undergoing revision in other respects and there is need for action in counteracting the views of the open-window advocates in that state.

Mr. McCornack told of a design he had made for a high school in a State having no ventilation requirements. The open-window system which was designed, when compared with a design for a unit system, confirmed the views of the previous speaker in showing the relatively high cost of the window method.

He concluded his paper with a design for a unit ventilator system which he regarded as the solution of some of the problems connected with high cost. With this method he would adopt certain construction economies involving the use of only points of support, putting the partitions where the practical demands of the problem require them to go and thus eliminate internal duct work and utilize the corridors for vent ducts.

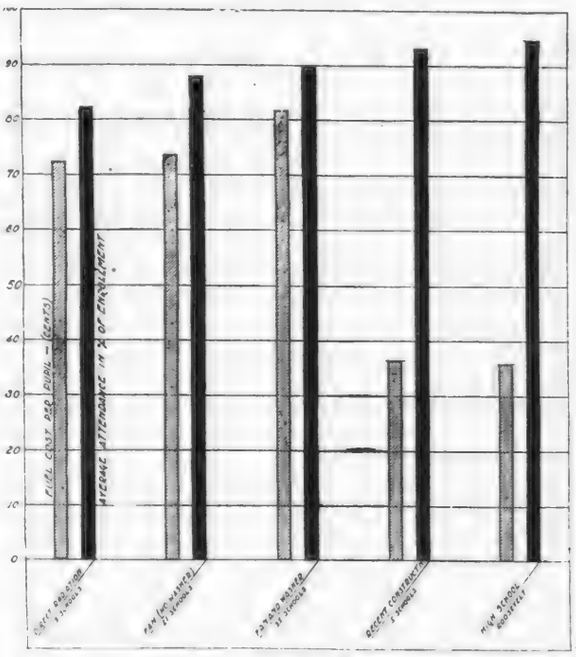
A hearty round of applause greeted E. S. Hallett, chief engineer of the St. Louis Board of Education, as he rose to present his paper on "Contribution of the Engineer to Comfort and Health in the School."

## Contribution of the Engineer to Comfort and Health in Schools

It goes without saying that those members of the society either specifically or generally interested in the subject in school air conditioning looked forward to the St. Louis convention as affording an opportunity to personally inspect the schools in St. Louis about which they had heard so much at former meetings. The paper by Edwin S. Hallett, chief engineer St. Louis board of education, formed a fitting prologue for these personally conducted tours.

THE CONTRIBUTIONS OF THE ENGINEERS TO COMFORT AND HEALTH IN THE SCHOOLS

"More progress has been made in ventilation," said Mr. Hallett, "considering its effect on vital statistics and in commercial awakening, within the past six years, than has occurred in the history of the world before. It is a simple matter for the engineer, in the present status of the art, to produce any predetermined air condition in a school or other building. In the discussion of the New York report it was frequently asserted by engineers that if the Health Association would define, or rather prescribe, the air condition which they considered best, they, the engineers, would agree to produce that air condition. There was probably some sarcasm in such remarks, for it would be preposterous to assume that satisfactory theoretical standards could be set up by any person or association. It is not so simple a matter as that and never could be solved in that way."




**Attendance in Percentage of Enrollment in School Groups With Various Kinds of Heating Systems, Including Fuel Consumed per Pupil per Year**

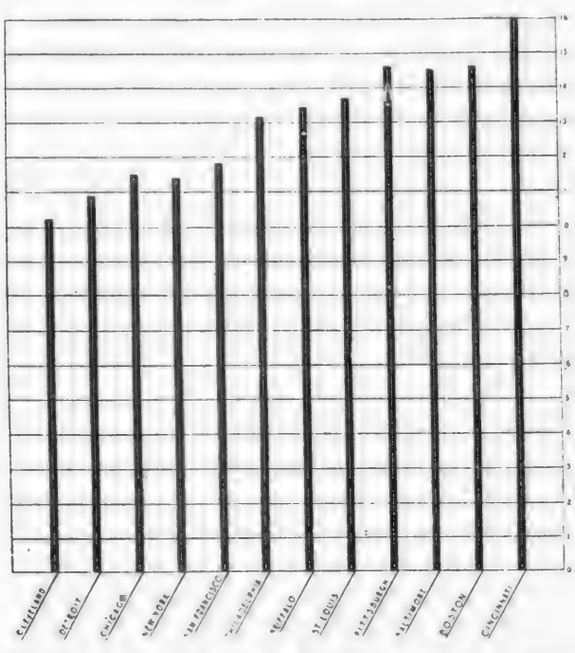
Mr. Hallett then accorded to Dr. E. Vernon Hill full recognition for his synthetic air chart and outlined its fundamentals. Speaking of the necessity for complete control of the three elementary factors in air conditioning, Mr. Hallett said: "We may be headed for a single control on radio but we are in for three dials on schoolhouse ventilation control as yet. We hope to "gang" the controls of temperature and humidity but so far a successful humidostat has not been put on the market. The two separate instruments are installed together, each having a fixed arbitrary setting.

"The air motion control is the subject of greatest divergencies and the one to which the writer has given much time and study to obtain practical and reliable operating results. As our scientific knowledge broadens, the wonder grows that we are able to survive the onslaught of disease germs.

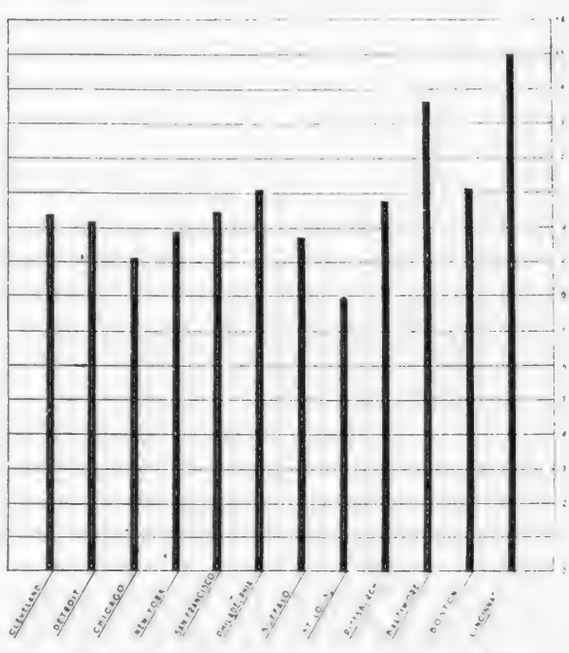
"The public has recognized the necessity of bacteria-free food and water and the diseases so induced have disappeared. But as to the air to breathe they have not done their duty. They are still paying the high price for city-poisoned air, in the high death rate from tuberculosis and other respiratory diseases. Complete mechanical ventilation is the answer and is the only answer that can ever be effective.

"Then there is a class of injurious substances even more serious than bacteria; that is the air poisoning sulphur dioxide and carbon monoxide. Coal burned in the heating and power furnaces contains large percentages of sulphur. It is so strong as to be actually irritating to the mucous membranes and is the cause of great injury to plants. It is easily discernible that delicate plants are seriously injured by such sulphur fumes, yet children are injured more than plants are. The new menace to life is the insidious carbon monoxide of the automobile exhaust."

In opening the discussion on the four papers presented, Professor S. E. Dibble read a resolution which had been taken



**Graph Showing Death Rate per 1000 in Twelve Cities**



**Death Rate per 1000 in Twelve Cities from Tuberculosis and Influenza**

from the report of a committee of the American Public Health Association, but which had never been published, to the effect that the association's action in coming out in favor of open-window ventilation may have been somewhat hasty, and recommending that further study be given the subject before coming to a final decision on the subject.

Mr. Hallett made the interesting statement that the new Medical Society Building in St. Louis, which is the headquarters of the medical profession in that city, after a careful investigation of the ventilating systems installed in the St. Louis schools, had adopted a similar scheme for that building including both recirculation and the use of ozone. The design was made by Mr. Hallett's son, a consulting engineer of St. Louis.

In the preliminary routine business, at the same session, it was stated that Volume 32 of the Transactions would be ready for distribution in February. In connection with the Publication of the *Guide*, Professor S. E. Dibble, of the Publication Committee, stated that there were 8,200 copies of the 1925-6 *Guide* printed, costing $1.84 each, while in 1926-7 8,025 copies were published, costing $1.79 each.

## Afternoon Session, January 27

Thursday afternoon was devoted to a Research Session. H. P. Gant, chairman of the Research Committee, took the chair and called first upon Samuel R. Lewis, chairman of the Committee on Subjects. Mr. Lewis included among the subjects which have been formally passed on and favorably recommended to the Committee on Research, the following:

### INVESTIGATIONS RECOMMENDED FOR CONSIDERATION BY THE RESEARCH LABORATORY

Physiological reactions of human beings under various atmospheric conditions. This investigation is now under way. In this connection Mr. Lewis referred to the new scale acquired by the Research Laboratory so delicate that it shows the loss in weight of persons due to evaporation of moisture and loss of heat constantly going on, even during the few seconds when the weight is being read. A view of this was later thrown on the screen.

Safe limits of recirculation, especially with mechanical ventilation. This has not yet been undertaken, but incidental data are being acquired. A study of effects in existing buildings using recirculation may be the ultimate method adopted for this investigation.

Critical velocities of liquids and gases.

Steam risers for both single-pipe and two-pipe systems. This work is being done under the direction of the Research Laboratory at Carnegie Institute of Technology.

Influence of air valve orifices in single-pipe heating systems.

Relative efficiencies of water-type direct radiators and steam-type direct radiators, when used for steam or vapor heating.

Radiator rating code. The proposed code, as presented later by R. V. Frost, was formally adopted by the society.

Investigation of efficiencies and capacities of sheet-metal radiation. This has been proposed, it was stated, because there are many new and revolutionary types of this form of heating surface on the market, with possibly some question as to full and definite knowledge by the manufacturer of the efficiencies and capacities.

Infiltration of air through building construction, now under way. There are two test walls built into two air-tight cabinets at the laboratory, with fans, gauges, etc., for complete tests under various conditions. It is hoped that these investigations, which are being pushed vigorously, will result in improved types of building construction.

Effect of air infiltration through chimneys, especially in outside walls and through tile flue linings. This investigation has not yet been undertaken. It is felt that a demonstration of infiltration through masonry and means of its reduction will apply to chimney construction, as well as to outside wall construction.

Heat loss through building materials, stopped in 1924, but to be pushed through to completion immediately. The heat meter developed at the laboratory is figuring largely in this investigation. In one series of tests several of these plates have been under observation for some time in the roof of the laboratory under different exposure conditions. Mr. Lewis stated that investigations are now under way by the laboratory for using this meter to enlarge and to improve the society's formulas for computations of heat transmission through building construction. Tests of the influence of the sun, of rain, of ice, etc., on walls and roofs have all been suggested and will be investigated and reported upon as rapidly as possible.

Ventilation by cold-air introduction. This is new and has to do with the determination of permissible temperatures and volumes, and the effect on comfort of the occupants under various conditions.

Boilers. This is also new and the investigation, as proposed, will cover combustion chamber area, internal water circulation, especially as to influence of free circulation below water-line of steam boilers; cause of priming, appliances to measure and to detect priming, and effect of core sand or chemical residuals on priming and steaming. It is suggested that this work be carried out under the laboratory's direction, at college laboratories, already equipped, and in laboratories maintained by several of the manufacturers of boilers.

Value of ozone as a destroyer of bacteria and as a vitalizer of air. This study was commenced in 1921, but the work was stopped before any determination of the effect of ozone on odors and bacteria was made.

Recirculation unit heaters as in industrial plants. This is new. There is lack of uniformity and agreement, stated Mr. Lewis, as to what happens in connection with air circulation in such plants and there is need for more information as to the effects of velocities of air discharge, volume handled in relation to temperature of discharge, location of heater in room, etc.

### OTHER TOPICS HELD IN RESERVE

Other topics which have been proposed to the Committee on Subjects but which are being held in reserve are:

Tests of proprietary articles and devices, after the manner of the Underwriters' Laboratories in Chicago or the test bureau of the American Medical Association. There are many new devices, stated Mr. Lewis, which would very quickly receive appreciation and wide use if they had merit which could be certified to by such an institution as the Research Laboratory. There are others which, having no merit, yet receive considerable use and involve some waste and trouble before their weakness is discovered. The laboratory, he added, could discover the weakness very quickly and possibly could help in remedying and improving the defects. Up to this time, he stated, for fear of charges of favoritism and with appreciation of trade jealousies, the way has not seemed clear for the laboratory to test anything for any particular concern.

Increased efficiency of workers due to adequate heating and ventilation.

Velocity of air created by indirect radiators, with special reference to conventional cast-iron indirect radiators under floor registers or at bases at flues. As Mr. Lewis stated, it has, however, an important and ultra-modern application in concealed radiators in local recirculating flues, which are being recognized as powerful competitors of exposed cast-iron direct radiators.

Effect of painting and bronzing radiators.

### ADOPTION OF RADIATOR TESTING CODE

For the Technical Advisory Committee on Radiation, R. V. Frost presented details of a proposed code for testing radiators. Later, a proposal by F. D. Mensing that the society adopt the code led to an animated discussion, the feeling being expressed by some that the proposed code should first be sent out to the members for their suggestions and criticisms. When the matter came to a vote the code was adopted by an overwhelming majority.

Director F. C. Houghten of the Research Laboratory made his report by presenting lantern slides of the progress of the various investigations on which data had been secured, including infiltration of air through walls of plain brick, with plaster and other finishes and results of heat transmission through walls using the heat meter. The tests included several that were made in the Schenley Apartments and in the Schenley Hotel, both in Pittsburgh; in Webster Hall, in a two-story store building and in a dwelling. The test data

for the heat flow through the roof of the Bureau of Mines Building were also given. The interesting statement was made that a calibration of the heat meter, after two years' use, showed little deterioration or error.

For the Technical Advisory Committee on Pipe Sizes, C. V. Haynes read a report prepared by Chairman J. A. Donnelly, outlining the technique to be followed in further tests. Some interesting slides on the research work already done in this connection were presented by Mr. O'Connell of the Research Laboratory staff, covering steam flow in risers from 1½ to 3 in. in diameter. There was also a slide shown in the form of a table giving the capacities of steam risers, up-feed, single-pipe and two-pipe, from 1 to 3 in. in diameter. The figures, it was stated, were as yet tentative and were not ready for final release by the laboratory.

The session closed with the presentation of a paper by C. P. Yaglou on "The Seasonal Variation in the Optimum Temperature for Comfort."

## Morning Session, January 28

From the viewpoints of variety and sustained interest, the Friday morning session closely rivaled the schoolhouse session. In his first paper presented to the society C. A. Dunham, president of the C. A. Dunham Company, discussed some new developments in the heating field under the title of "Pressure Differences in Steam Heating Systems and Their Bearing on Operation." Mr. Dunham pointed out the advantages to be secured in two-pipe gravity steam systems when they were altered so as to operate at high vacuum in times of mild weather.

The scheme involves the use of thermostatic traps on the radiator return connections, automatic air vents on the return lines and a vacuum pump equipped with a differential controller.

Charts were included with the presentation, showing the percentage of radiators turned on at various outside temperatures, while other curves illustrated condensation and fuel cost comparisons.

The conclusions reached in the paper were that the differential idea provides a more efficient method of steam heating, as the condensate decreases proportionately as the outside temperature decreases. While the cost of heating decreases for similar systems with the rise in the outside temperature, it decreases more rapidly with the differential vacuum system.

Discussion of the paper brought out the argument that it would be necessary to manipulate a large number of valves in the operation of the new system and that temperature control would accomplish the same result. In reply, Mr. Dunham stated that no manipulation of valves was required and that temperature control, if installed, could not give equal economies in fuel consumption.

Inquiry was made as to the method of determining the amount of differential required, and this was stated to be whatever amount proved to be necessary in order to heat every radiator, that smaller pipe sizes would require a higher differential to be maintained, and that larger pipe sizes, with the resulting drop in friction, could operate on a smaller differential.

One speaker thought that the installation as shown must be overloaded with radiation, as the curves did not show that all the radiators were turned on, even with the temperature near zero. This was explained by the statement that the job was designed for a —10° F. minimum outside temperature.

SAMUEL R. LEWIS NEW CHAIRMAN OF COMMITTEE ON RESEARCH

Announcement was made at this time that Samuel R. Lewis had been elected chairman of the Committee on Research, succeeding H. P. Gant, whose term had expired.

In the absence of G. E. Otis, his paper on "Development of Built-In Heating Units," was presented by J. M. Robb.

In the ensuing discussion, one speaker pointed out that the rating of built-in or "invisible" type of radiator should be based on condensation quantities. A question was raised as to whether the Fire Underwriters would approve the flue feature, while another point brought out was the possible loss of efficiency after a lapse of time, due to the accumulation of dust. One speaker thought the carbonization of dust might discolor the walls and ceiling.

Mr. Robb stated that as the flues extended only between floors and not through the floors, the fire hazard could be considered negligible, also that dust had not made enough difference in the radiator efficiency to be noticeable.

L'R. G. Bousquet, whose previous contribution to the society of a paper dealing with the Cartridge type of copper radiator will be remembered, presented what was, in some respects a supplementary paper, on the subject of "Turbulence and Heat Transfer."

In the discussion a number of inquiries turned on the point as to why two types of radiators had been selected for the experiments. The author explained that this was done simply for the reason that they represented two standard types of heating surface. A written discussion by L. A. Soule, of the Aerofin Corporation was also read.

C. W. Tomlinson presented the concluding paper of the meeting on "Dehumidification Methods."

One of the points brought out in the discussion was that the scheme described would function most satisfactorily in cases where the requirements were fairly constant and the dewpoint below 32° F. Mr. Tomlinson stated that the method described by him had already been tried out and in at least one case had proved successful. He also stated that there was a considerable advantage in using two compressor expander units.

E. S. Hallett and Professor J. D. Hoffman were appointed a committee to escort the newly elected officers and members of the council to the platform where they were installed with due ceremony.

The new president, Dean Anderson, announced that new business was in order and, under this heading, C. W. Tomlinson offered a suggestion for a definite code of instructions for the benefit of would-be contributors, in the form of rules for their guidance. He also made the suggestion that papers be presented at the meetings in abstract. On motion, this matter was referred to the council, as were the numerous invitations received for holding the next semi-annual meeting some time in June. Among the points mentioned were Hot Springs, Va.; White Sulphur Springs, W. Va.; Milwaukee, Wis.; and West Baden Springs, Ind. An interesting point in this connection is that the National District Heating Association is to hold its next annual meeting in West Baden Springs, May 10-13, next, while the Heating and Piping Contractors National Association will meet at the same place during the first week in June.

Among the resolutions of thanks one for Secretary A. V. Hutchinson was proposed and warmly endorsed by President Anderson. He called for a rising vote which was given with enthusiasm.

Another motion, offered by Mr. Lane and adopted by the meeting, provided for the publication, in the form of a brochure, of the papers presented at the school house ventilation session, to be broadcast to architects, school boards and others interested in school work.

## Notes of the Meeting

One of the many thoughtful acts on the part of the St. Louis Chapter was the distribution of a pocket-sized notebook which the delegates found in their seats as they entered the meeting room.

Souvenirs presented at the society's annual dinner consisted of metal paper weights for the men in the shape of miniature figures of a police dog. The sentiment which went with the souvenir was the wish that the visitors would have a "dog-gone" good time in St. Louis. The ladies were presented with vases.

## Heating Contractors to Meet at West Baden Springs

Announcement has been made that the forthcoming annual convention of the Heating and Piping Contractors National Association will be held at West Baden, Ind., June 1-4, next. Headquarters will be at the West Baden Springs Hotel. The fact that the National District Heating Association will meet at the same point May 15-18, will bring West Baden in the limelight this year as the headquarters, for the time being, of the heating industry.

The A. S. H. and V. E. Dinner, Annual Meeting, Hotel Statler, St. Louis, Mo., January 27, 1927

**INFILTRATION**

| | | | |
|---|---|---|---|
| Stationary Wood Sash | 25 | French Doors | 100 |
| Double Hung Wood Sash | 50 | Outside Doors | 200 |
| Double Hung Steel Sash | 100 | Outside Doors with Storm Doors | 100 |
| Casement Windows | 100 | Outside Doors with Inner Vestibule Doors | 100 |
| Fenestra | 100 | | |

Metal Weather Strip Deducts 50%

# HEATING AND PIPING CONTR

## STANDARD RADIA

### SHOWING RADIATION REQU

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| 3 Col 38" St'm Rad | GLASS | | INFILTRATION | | | | OUTSIDE WALL | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Win. or Door | Sky Light | Rate per Lin. Ft. | | | | Plain Brick | | | Brick and Pl. | | | Brick Fur. L. P. | | | Br. 4" Tile Pl. | | | Plain Co | |
| | | | 25 | 50 | 100 | 200 | 8" | 12" | 16" | 8" | 12" | 16" | 8" | 12" | 16" | 4" | 8" | 12" | 8" | 12" |
| | 1.1 | 1.3 | 0.45 | 0.9 | 1.8 | 3.6 | .42 | .32 | .26 | .38 | .29 | .25 | .27 | .23 | .21 | .30 | .26 | .22 | .60 | .48 |
| 225 | 27.5 | 32.5 | 11.25 | 22.5 | 45.0 | 90.0 | 10.5 | 8.00 | 6.50 | 9.50 | 7.25 | 6.25 | 6.75 | 5.75 | 5.25 | 7.50 | 6.50 | 5.50 | 15.0 | 12.0 |
| 1 | 8.18 | 6.92 | 20.0 | 10.0 | 5.0 | 2.5 | 21.4 | 28.1 | 34.6 | 23.7 | 31.0 | 36.0 | 33.3 | 39.1 | 42.9 | 30.0 | 34.6 | 40.9 | 15.0 | 18.8 |
| 2 | 16.4 | 13.8 | 40.0 | 20.0 | 10.0 | 5.0 | 42.8 | 56.2 | 69.2 | 47.4 | 62.0 | 72.0 | 66.6 | 78.2 | 85.8 | 60.0 | 69.2 | 81.8 | 30.0 | 37.6 |
| 3 | 24.5 | 20.8 | 60.0 | 30.0 | 15.0 | 7.5 | 64.6 | 84.3 | 104 | 71.1 | 93.0 | 108 | 99.9 | 117 | 129 | 90.0 | 104 | 123 | 45.0 | 56.4 |
| 4 | 32.7 | 27.7 | 80.0 | 40.0 | 20.0 | 10.0 | 85.6 | 112 | 138 | 94.8 | 124 | 144 | 133 | 156 | 172 | 120 | 138 | 164 | 60.0 | 75.2 |
| 5 | 40.9 | 34.6 | 100 | 50.0 | 25.0 | 12.5 | 107 | 141 | 173 | 119 | 155 | 180 | 167 | 196 | 215 | 150 | 173 | 205 | 75.0 | 94.0 |
| 6 | 49.1 | 41.5 | 120 | 60.0 | 30.0 | 15.0 | 128 | 169 | 208 | 142 | 186 | 216 | 200 | 235 | 257 | 180 | 208 | 245 | 90.0 | 113 |
| 7 | 57.3 | 48.4 | 140 | 70.0 | 35.0 | 17.5 | 150 | 197 | 242 | 166 | 217 | 252 | 233 | 274 | 300 | 210 | 242 | 286 | 105 | 132 |
| 8 | 65.4 | 55.4 | 160 | 80.0 | 40.0 | 20.0 | 171 | 225 | 277 | 190 | 248 | 288 | 266 | 313 | 343 | 240 | 277 | 327 | 120 | 150 |
| 9 | 73.6 | 62.3 | 180 | 90.0 | 45.0 | 22.5 | 193 | 253 | 311 | 213 | 279 | 324 | 300 | 352 | 386 | 270 | 311 | 368 | 135 | 169 |
| 10 | 81.8 | 69.2 | 200 | 100 | 50.0 | 25.0 | 214 | 281 | 346 | 237 | 310 | 360 | 333 | 391 | 429 | 300 | 346 | 409 | 150 | 188 |
| 11 | 90.0 | 76.1 | 220 | 110 | 55.0 | 27.5 | 235 | 309 | 381 | 261 | 341 | 396 | 366 | 430 | 472 | 330 | 381 | 450 | 165 | 207 |
| 12 | 98.2 | 83.0 | 240 | 120 | 60.0 | 30.0 | 257 | 337 | 415 | 284 | 372 | 432 | 400 | 469 | 515 | 360 | 415 | 491 | 180 | 226 |
| 13 | 106 | 90.0 | 260 | 130 | 65.0 | 32.5 | 278 | 365 | 450 | 308 | 403 | 468 | 433 | 508 | 558 | 390 | 450 | 532 | 195 | 244 |
| 14 | 114 | 96.9 | 280 | 140 | 70.0 | 35.0 | 300 | 393 | 484 | 332 | 434 | 504 | 466 | 547 | 601 | 420 | 484 | 573 | 210 | 263 |
| 15 | 123 | 104 | 300 | 150 | 75.0 | 37.5 | 321 | 422 | 519 | 356 | 465 | 540 | 500 | 587 | 644 | 450 | 519 | 614 | 225 | 282 |
| 16 | 131 | 111 | 320 | 160 | 80.0 | 40.0 | 342 | 450 | 554 | 379 | 496 | 576 | 533 | 626 | 686 | 480 | 554 | 654 | 240 | 301 |
| 17 | 139 | 118 | 340 | 170 | 85.0 | 42.5 | 364 | 478 | 588 | 403 | 527 | 612 | 566 | 665 | 729 | 510 | 588 | 695 | 255 | 320 |
| 18 | 147 | 125 | 360 | 180 | 90.0 | 45.0 | 385 | 506 | 623 | 427 | 558 | 648 | 599 | 704 | 772 | 540 | 623 | 736 | 270 | 338 |
| 19 | 155 | 131 | 380 | 190 | 95.0 | 47.5 | 407 | 534 | 657 | 450 | 589 | 684 | 633 | 743 | 815 | 570 | 657 | 777 | 285 | 357 |
| 20 | 164 | 138 | 400 | 200 | 100 | 50.0 | 428 | 562 | 692 | 474 | 620 | 720 | 666 | 782 | 858 | 600 | 692 | 818 | 300 | 376 |
| 21 | 172 | 145 | 420 | 210 | 105 | 52.5 | 449 | 590 | 727 | 498 | 651 | 756 | 699 | 821 | 901 | 630 | 727 | 859 | 315 | 395 |
| 22 | 180 | 152 | 440 | 220 | 110 | 55.0 | 471 | 618 | 761 | 521 | 682 | 792 | 733 | 860 | 944 | 660 | 761 | 900 | 330 | 414 |
| 23 | 188 | 159 | 460 | 230 | 115 | 57.5 | 492 | 646 | 796 | 545 | 713 | 828 | 766 | 899 | 987 | 690 | 796 | 941 | 345 | 432 |
| 24 | 196 | 166 | 480 | 240 | 120 | 60.0 | 514 | 674 | 830 | 569 | 744 | 864 | 799 | 938 | 1030 | 720 | 830 | 982 | 360 | 451 |
| 25 | 204 | 173 | 500 | 250 | 125 | 62.5 | 535 | 703 | 865 | 593 | 775 | 900 | 833 | 978 | 1073 | 750 | 865 | 1023 | 375 | 470 |

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| | | | |
|---|---|---|---|
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Metal Weather Strip Deducts 50%

# HEATING AND PIPING CONTR

## STANDARD RADIAT

### SHOWING RADIATION REQUI

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| 3 Col 38" St'm Rad | GLASS | | INFILTRATION | | | | OUTSIDE WALL | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Win. or Door | Sky Light | Rate per Lin. Ft. | | | | Plain Brick | | | Brick and Pl. | | | Brick Fur. L. P. | | | Br. 4" Tile Pl. | | | Plain Con | |
| | | | 25 | 50 | 100 | 200 | 8" | 12" | 16" | 8" | 12" | 16" | 8" | 12" | 16" | 4" | 8" | 12" | 8" | 12" |
| | 1.1 | 1.3 | 0.45 | 0.9 | 1.8 | 3.6 | .42 | .32 | .26 | .38 | .29 | .25 | 27 | 23 | 21 | 30 | 26 | 22 | 60 | 48 |
| 225 | 82.5 | 97.5 | 33.8 | 67.5 | 135 | 270 | 31.5 | 24.0 | 19.5 | 28.5 | 21.8 | 18.8 | 20.3 | 17.3 | 15.8 | 22.5 | 19.5 | 16 5 | 45.0 | 36.0 |
| 1 | 2.73 | 2.31 | 6.66 | 3.33 | 1.67 | 0.83 | 7.14 | 9.38 | 11.5 | 7.90 | 10.3 | 12 0 | 11.1 | 13.0 | 14.3 | 10.0 | 11.5 | 13 6 | 5 00 | 6 25 |
| 2 | 5.46 | 4.62 | 13.3 | 6.66 | 3.34 | 1.66 | 14.3 | 18.8 | 23.0 | 15.8 | 20.6 | 24.0 | 22.2 | 26.0 | 28.6 | 20.0 | 23.0 | 27 2 | 10.0 | 12.5 |
| 3 | 8.19 | 6.93 | 20.0 | 9.99 | 5.01 | 2.49 | 21.4 | 28.1 | 34.5 | 23.7 | 30.9 | 36.0 | 33.3 | 39.0 | 42.9 | 30.0 | 34.5 | 40.8 | 15.0 | 18.8 |
| 4 | 10.9 | 9.24 | 26.6 | 13.3 | 6.68 | 3.32 | 28.6 | 37.5 | 46.0 | 31.6 | 41.2 | 48.0 | 44.4 | 52.0 | 57.2 | 40.0 | 46.0 | 54.4 | 20.0 | 25.0 |
| 5 | 13.7 | 11.2 | 33.3 | 16.7 | 8.35 | 4.15 | 35.7 | 46.9 | 57.5 | 39.5 | 51.5 | 60.0 | 55.5 | 65.0 | 71.5 | 50.0 | 57.5 | 68 0 | 25.0 | 31 3 |
| 6 | 16.4 | 13.9 | 40.0 | 20.0 | 10.0 | 4.98 | 42.8 | 56.3 | 69.0 | 47.4 | 61.8 | 72.0 | 66.6 | 78.0 | 85.8 | 60.0 | 69.0 | 81.6 | 30.0 | 37.5 |
| 7 | 19.1 | 16.2 | 46.6 | 23.3 | 11.7 | 5.81 | 50.0 | 65.7 | 80.5 | 55.3 | 72.1 | 84.0 | 77.7 | 91.0 | 100 | 70.0 | 80.5 | 95 2 | 35.0 | 43 8 |
| 8 | 21.8 | 18.5 | 53.3 | 26.6 | 13.4 | 6.64 | 57.1 | 75.0 | 92.0 | 63.2 | 82.4 | 96.0 | 88.8 | 104 | 114 | 80.0 | 92.0 | 109 | 40 0 | 50.0 |
| 9 | 24.6 | 20.8 | 59.9 | 30.0 | 15.0 | 7.47 | 64.3 | 84.4 | 104 | 71.1 | 92.7 | 108 | 99.9 | 117 | 129 | 90.0 | 104 | 122 | 45 0 | 56.3 |
| 10 | 27.3 | 23.1 | 66.6 | 33.3 | 16.7 | 8.30 | 71.4 | 93 8 | 115 | 79.0 | 103 | 120 | 111 | 130 | 143 | 100 | 115 | 136 | 50 0 | 62.5 |
| 11 | 30.0 | 25.4 | 73.3 | 36.6 | 18.4 | 9.13 | 78.5 | 103 | 127 | 86.9 | 113 | 132 | 122 | 143 | 157 | 110 | 127 | 150 | 55 0 | 68 8 |
| 12 | 32.8 | 27.7 | 79.9 | 40.0 | 20.0 | 9.96 | 85.7 | 113 | 138 | 94.8 | 124 | 144 | 133 | 156 | 172 | 120 | 138 | 163 | 60 0 | 75 0 |
| 13 | 35.5 | 30.0 | 86.6 | 43.3 | 21.7 | 10.8 | 92.8 | 122 | 150 | 103 | 134 | 156 | 144 | 169 | 186 | 130 | 150 | 177 | 65.0 | 81 3 |
| 14 | 38.2 | 32.3 | 93.2 | 46.6 | 23.4 | 11.6 | 100 | 131 | 161 | 111 | 144 | 168 | 155 | 182 | 200 | 140 | 161 | 190 | 70 0 | 87 5 |
| 15 | 41.0 | 34.7 | 99.9 | 50.0 | 25.1 | 12.5 | 107 | 141 | 173 | 119 | 155 | 180 | 167 | 195 | 215 | 150 | 173 | 204 | 75 0 | 93 8 |
| 16 | 43.7 | 37.0 | 107 | 53.3 | 26.7 | 13.3 | 114 | 150 | 184 | 126 | 165 | 192 | 178 | 208 | 229 | 160 | 184 | 218 | 80 0 | 100 |
| 17 | 46.4 | 39.3 | 113 | 56.6 | 28.4 | 14.1 | 121 | 159 | 196 | 134 | 175 | 204 | 189 | 221 | 243 | 170 | 196 | 231 | 85 0 | 106 |
| 18 | 49.1 | 41.6 | 120 | 60.0 | 30.1 | 14.9 | 129 | 169 | 207 | 142 | 185 | 216 | 200 | 234 | 257 | 180 | 207 | 245 | 90 0 | 113 |
| 19 | 51.9 | 43.9 | 127 | 63.3 | 31.7 | 15.8 | 136 | 178 | 219 | 150 | 196 | 228 | 211 | 247 | 272 | 190 | 219 | 258 | 95 0 | 119 |
| 20 | 54.6 | 46.2 | 133 | 66.6 | 33.4 | 16.6 | 143 | 188 | 230 | 158 | 206 | 240 | 222 | 260 | 286 | 200 | 230 | 272 | 100 | 125 |
| 21 | 57.3 | 48.5 | 140 | 69.9 | 35.1 | 17.4 | 150 | 197 | 242 | 166 | 216 | 252 | 233 | 273 | 300 | 210 | 242 | 286 | 105 | 131 |
| 22 | 60.1 | 50.8 | 147 | 73.3 | 36.7 | 18.3 | 157 | 206 | 253 | 174 | 227 | 264 | 244 | 286 | 315 | 220 | 253 | 299 | 110 | 138 |
| 23 | 62.8 | 53.1 | 153 | 76.6 | 38.4 | 19.1 | 164 | 216 | 265 | 182 | 237 | 276 | 255 | 299 | 329 | 230 | 265 | 313 | 115 | 144 |
| 24 | 65.5 | 55.4 | 160 | 79.9 | 40.1 | 19.9 | 171 | 225 | 276 | 190 | 247 | 288 | 266 | 312 | 343 | 240 | 276 | 326 | 120 | 150 |
| 25 | 68.3 | 57.8 | 167 | 83.3 | 41.8 | 20.8 | 179 | 235 | 288 | 198 | 258 | 300 | 278 | 325 | 358 | 250 | 288 | 340 | 125 | 156 |

# NG CONTRACTORS NATIONAL ASSOCIATIO

## ARD RADIATION ESTIMATING TABLE

## ADIATION REQUIRED FOR QUANTITIES INDICATED

ciation. For Other Construction than that Shown SeeHeating and Piping Contractors National Association Engin

| WALLS | | | | | | | | | | | ROOF | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ile Pl. | | Plain Conc. | | | Conc. Fur L. P. | | | Frame Std. | Frame No Sh'g | Frame No L. P. | T&G on 1" Bd. | T&G on 4" Conc. | Sh'gle on Sh'g | Sh'gl Sh'g L. P. |
| | 12" | 8" | 12" | 16" | 8" | 12" | 16" | | | | | | | |
| 6 | .22 | .60 | .48 | .41 | .50 | .40 | .34 | .24 | .31 | .35 | .30 | .60 | .40 | .30 |
| 50 | 5.50 | 15.0 | 12.0 | 10.25 | 12.5 | 10.0 | 8.50 | 6.00 | 7.75 | 8.75 | 7.50 | 15.0 | 10.0 | 7.50 |
| .6 | 40.9 | 15.0 | 18.8 | 22.0 | 18.0 | 22.5 | 26.5 | 37.5 | 29.0 | 25.7 | 30.0 | 15.0 | 22.5 | 30.0 |
| .2 | 81.8 | 30.0 | 37.6 | 44.0 | 36.0 | 45.0 | 53.0 | 75.0 | 58.0 | 51.4 | 60.0 | 30.0 | 45.0 | 60.0 |
| 04 | 123 | 45.0 | 56.4 | 66.0 | 54.0 | 67.5 | 79.5 | 113 | 87.0 | 77.1 | 90.0 | 45.0 | 67.5 | 90.0 |
| 38 | 164 | 60.0 | 75.2 | 88.0 | 72.0 | 90.0 | 106 | 150 | 116 | 103 | 120 | 60.0 | 90.0 | 120 |
| 73 | 205 | 75.0 | 94.0 | 110 | 90.0 | 113 | 133 | 188 | 145 | 129 | 150 | 75.0 | 113 | 150 |
| 08 | 245 | 90.0 | 113 | 132 | 108 | 135 | 159 | 225 | 174 | 154 | 180 | 90.0 | 135 | 180 |
| 42 | 286 | 105 | 132 | 154 | 126 | 158 | 186 | 263 | 203 | 188 | 210 | 105 | 158 | 210 |
| 77 | 327 | 120 | 150 | 176 | 144 | 180 | 212 | 300 | 232 | 206 | 240 | 120 | 180 | 240 |
| 11 | 368 | 135 | 169 | 198 | 162 | 203 | 239 | 338 | 261 | 231 | 270 | 135 | 203 | 270 |
| 46 | 409 | 150 | 188 | 220 | 180 | 225 | 265 | 375 | 290 | 257 | 300 | 150 | 225 | 300 |
| 81 | 450 | 165 | 207 | 242 | 198 | 248 | 292 | 413 | 319 | 283 | 330 | 165 | 248 | 330 |
| 15 | 491 | 180 | 226 | 264 | 216 | 270 | 318 | 450 | 348 | 308 | 360 | 180 | 270 | 360 |
| 50 | 532 | 195 | 244 | 286 | 234 | 293 | 345 | 488 | 377 | 334 | 390 | 195 | 293 | 390 |
| 84 | 573 | 210 | 263 | 308 | 252 | 315 | 371 | 525 | 406 | 360 | 420 | 210 | 315 | 420 |
| 19 | 614 | 225 | 282 | 330 | 270 | 338 | 398 | 563 | 435 | 386 | 450 | 225 | 338 | 450 |
| 54 | 654 | 240 | 301 | 352 | 288 | 360 | 424 | 600 | 464 | 411 | 480 | 240 | 360 | 480 |
| 88 | 695 | 255 | 320 | 374 | 306 | 383 | 451 | 638 | 493 | 437 | 510 | 255 | 383 | 510 |
| 23 | 736 | 270 | 338 | 396 | 324 | 405 | 477 | 675 | 522 | 463 | 540 | 270 | 405 | 540 |
| 57 | 777 | 285 | 357 | 418 | 342 | 428 | 504 | 713 | 551 | 488 | 570 | 295 | 428 | 570 |
| 92 | 818 | 300 | 376 | 440 | 360 | 450 | 530 | 750 | 580 | 514 | 600 | 300 | 450 | 600 |
| 27 | 859 | 315 | 395 | 462 | 378 | 473 | 557 | 788 | 609 | 540 | 630 | 315 | 473 | 630 |
| 61 | 900 | 330 | 414 | 484 | 396 | 495 | 583 | 825 | 638 | 565 | 660 | 330 | 495 | 660 |
| 96 | 941 | 345 | 432 | 506 | 414 | 518 | 610 | 863 | 667 | 591 | 690 | 345 | 518 | 690 |
| 30 | 982 | 360 | 451 | 528 | 432 | 540 | 636 | 900 | 696 | 617 | 720 | 360 | 540 | 720 |
| 65 | 1023 | 375 | 470 | 550 | 450 | 563 | 663 | 938 | 725 | 643 | 750 | 375 | 563 | 750 |

# NG CONTRACTORS NATIONAL ASSOCIATIO

## DARD RADIATION ESTIMATING TABLE

## ADIATION REQUIRED FOR QUANTITIES INDICATED

iation. For Other Construction than that Shown See Heating and Piping Contractors National Association Engi

| E WALLS | | | | | | | | | | | ROOF | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tile Pl. | | Plain Conc. | | | Conc. Fur L. P. | | | Frame Std. | Frame No Sh'g | Frame No L. P. | T&G on 1" Bd. | T&G on 4" Conc. | Sh'gle on Sh'g | Sh'g Sh' L. F |
| " | 12" | 8" | 12" | 16" | 8" | 12" | 16" | | | | | | | |
| 26 | 22 | 60 | 48 | 41 | 50 | 40 | 34 | 24 | 31 | 35 | .30 | .60 | .40 | .3 |
| .5 | 16 5 | 45.0 | 36.0 | 30.8 | 37.5 | 30 0 | 25.5 | 18.0 | 23 3 | 26.3 | 22.5 | 45.0 | 30.0 | 22. |
| .5 | 13 6 | 5 00 | 6.25 | 7.31 | 6 00 | 7.50 | 8 82 | 12 5 | 9.66 | 8 56 | 10.0 | 5.00 | 7.50 | 10. |
| .0 | 27 2 | 10.0 | 12.5 | 14.6 | 12.0 | 15 0 | 17.6 | 25.0 | 19.3 | 17.1 | 20.0 | 10.0 | 15.0 | 20. |
| .5 | 40.8 | 15.0 | 18.8 | 21 9 | 18.0 | 22.5 | 26.5 | 37 5 | 29.0 | 25 7 | 30.0 | 15.0 | 22.5 | 30. |
| .0 | 54.4 | 20.0 | 25.0 | 29.2 | 24.0 | 30.0 | 35.3 | 50.0 | 38.6 | 34.2 | 40.0 | 20.0 | 30.0 | 40. |
| .5 | 68 0 | 25.0 | 31 3 | 36.6 | 30.0 | 37 5 | 44 1 | 62.5 | 48.3 | 42.8 | 50.0 | 25.0 | 37.5 | 50. |
| .0 | 81.6 | 30.0 | 37.5 | 43 9 | 36.0 | 45 0 | 52.9 | 75 0 | 58.0 | 51.4 | 60.0 | 30.0 | 45.0 | 60. |
| .5 | 95 2 | 35.0 | 43 8 | 51 2 | 42.0 | 52.5 | 61.7 | 87 5 | 67.6 | 59 7 | 70.0 | 35.0 | 52.5 | 70. |
| .0 | 109 | 40 0 | 50.0 | 58.5 | 48.0 | 60.0 | 70 6 | 100 | 77 3 | 68 5 | 80.0 | 40.0 | 60.0 | 80. |
| 04 | 122 | 45 0 | 56.3 | 65 8 | 54 0 | 67.5 | 79.4 | 113 | 86 9 | 77.0 | 90.0 | 45.0 | 67.5 | 90. |
| 15 | 136 | 50 0 | 62.5 | 73.1 | 60 0 | 75.0 | 88.2 | 125 | 96.6 | 85 6 | 100 | 50.0 | 75.0 | 10 |
| 27 | 150 | 55 0 | 68 8 | 80 4 | 66 0 | 82 5 | 97.0 | 138 | 106 | 94 2 | 110 | 55.0 | 82.5 | 11 |
| 38 | 163 | 60 0 | 75 0 | 87 7 | 72.0 | 90 0 | 106 | 150 | 116 | 103 | 120 | 60.0 | 90.0 | 12 |
| 50 | 177 | 65.0 | 81 3 | 95 0 | 78.0 | 97 5 | 115 | 163 | 126 | 111 | 130 | 65.0 | 97 5 | 13 |
| 61 | 190 | 70 0 | 87 5 | 102 | 84.0 | 105 | 123 | 175 | 135 | 120 | 140 | 70.0 | 105 | 14 |
| 73 | 204 | 75 0 | 93 8 | 110 | 90 0 | 113 | 132 | 188 | 145 | 128 | 150 | 75.0 | 113 | 15 |
| 84 | 218 | 80 0 | 100 | 117 | 96 0 | 120 | 141 | 200 | 155 | 137 | 160 | 80.0 | 120 | 16 |
| 96 | 231 | 85 0 | 106 | 124 | 102 | 128 | 150 | 213 | 164 | 146 | 170 | 85.0 | 128 | 17 |
| 07 | 245 | 90 0 | 113 | 132 | 108 | 135 | 159 | 225 | 174 | 154 | 180 | 90.0 | 135 | 18 |
| 19 | 258 | 95 0 | 119 | 139 | 114 | 143 | 168 | 238 | 184 | 163 | 190 | 95 0 | 143 | 19 |
| 30 | 272 | 100 | 125 | 146 | 120 | 150 | 176 | 250 | 193 | 171 | 200 | 100 | 150 | 20 |
| 42 | 286 | 105 | 131 | 154 | 126 | 158 | 185 | 263 | 203 | 180 | 210 | 105 | 158 | 21 |
| 53 | 299 | 110 | 138 | 161 | 132 | 165 | 194 | 275 | 213 | 188 | 220 | 110 | 165 | 22 |
| 65 | 313 | 115 | 144 | 168 | 138 | 173 | 203 | 288 | 222 | 197 | 230 | 115 | 173 | 23 |
| 76 | 326 | 120 | 150 | 175 | 144 | 180 | 212 | 300 | 232 | 205 | 240 | 120 | 180 | 24 |
| 88 | 340 | 125 | 156 | 183 | 150 | 188 | 221 | 313 | 242 | 214 | 250 | 125 | 188 | 25 |

N

ering Standards.

## NEW ORLEANS, LOUISIANA

**TEMPERATURE FACTORS**

| | |
|---|---|
| Room Temperature | 70°=$T_1$ |
| Base Temperature | +45°=$T_o$ |
| Base Temp. +45° Equivalent to Guarantee Temp. of +30° Outside | |

**EXPOSURE FACTORS**

| | | | |
|---|---|---|---|
| N | 1.50 | S | 1.00 |
| NE | 1.40 | SW | 1.00 |
| E | 1.25 | W | 1.50 |
| SE | 1.00 | NW | 1.50 |

| | Base Floor | | Interm'e Floor | | | Ceiling | | Partition | | | Type |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Conc. on Earth | Wood on Sleep. | 4" Conc. | 4" Conc. 3" Fill 1" Fin. | Double Wood | Lath and Plas. | L & P Wo. Fl. Over | Stud L & P 1 Side | Stud L & P 2 Side | | Kind |
| | | | | | | | | | | | Thick. |
| | .31 | .13 | .20 | 15 | 20 | .49 | .28 | .60 | .33 | | K |
| | 3.875 | 1.625 | 2.50 | 1.875 | 2.50 | 6.125 | 3.50 | 7.50 | 4.125 | | K(Ti-To) |
| | 58.1 | 138.5 | 90.0 | 120 | 90.0 | 36.7 | 64.3 | 30.0 | 54.6 | | 1 |
| | 116 | 277 | 180 | 240 | 180 | 73.4 | 129 | 60.0 | 109 | | 2 |
| | 174 | 416 | 270 | 360 | 270 | 110 | 193 | 90.0 | 164 | | 3 |
| | 232 | 554 | 360 | 480 | 360 | 147 | 257 | 120 | 218 | | 4 |
| | 291 | 693 | 450 | 600 | 450 | 184 | 322 | 150 | 273 | | 5 |
| | 349 | 831 | 540 | 720 | 540 | 220 | 386 | 180 | 328 | | 6 |
| | 407 | 970 | 630 | 840 | 630 | 257 | 450 | 210 | 382 | | 7 |
| | 465 | 1108 | 720 | 960 | 720 | 294 | 514 | 240 | 437 | | 8 |
| | 523 | 1247 | 810 | 1080 | 810 | 330 | 579 | 270 | 491 | | 9 |
| | 581 | 1385 | 900 | 1200 | 900 | 367 | 643 | 300 | 546 | | 10 |
| | 639 | 1524 | 990 | 1320 | 990 | 404 | 707 | 330 | 601 | | 11 |
| | 697 | 1662 | 1080 | 1440 | 1080 | 440 | 772 | 360 | 655 | | 12 |
| | 755 | 1801 | 1170 | 1560 | 1170 | 477 | 836 | 390 | 710 | | 13 |
| | 813 | 1939 | 1260 | 1680 | 1260 | 514 | 900 | 420 | 764 | | 14 |
| | 872 | 2078 | 1350 | 1800 | 1350 | 551 | 965 | 450 | 819 | | 15 |
| | 930 | 2216 | 1440 | 1920 | 1440 | 587 | 1029 | 480 | 874 | | 16 |
| | 988 | 2355 | 1530 | 2040 | 1530 | 624 | 1093 | 510 | 928 | | 17 |
| | 1046 | 2493 | 1620 | 2160 | 1620 | 661 | 1157 | 540 | 983 | | 18 |
| | 1104 | 2632 | 1710 | 2280 | 1710 | 697 | 1222 | 570 | 1037 | | 19 |
| | 1162 | 2770 | 1800 | 2400 | 1800 | 734 | 1286 | 600 | 1092 | | 20 |
| | 1220 | 2908 | 1890 | 2520 | 1890 | 771 | 1350 | 630 | 1147 | | 21 |
| | 1278 | 3047 | 1980 | 2640 | 1980 | 807 | 1415 | 660 | 1201 | | 22 |
| | 1336 | 3186 | 2070 | 2760 | 2070 | 844 | 1479 | 690 | 1256 | | 23 |
| | 1394 | 3324 | 2160 | 2880 | 2160 | 881 | 1543 | 720 | 1310 | | 24 |
| | 1453 | 3463 | 2250 | 3000 | 2250 | 918 | 1608 | 750 | 1365 | | 25 |

←——These Items Figured on Basis of K $\left(\frac{T_i - T_o}{2}\right)$ ——→

ON

neering Standards.

## ST. PAUL

**TEMPERATURE FACTORS**

| | |
|---|---|
| Room Temperature | 70°=$T_1$ |
| Base Temperature | —5°=$T_o$ |
| Base Temp. —5° Equivalent to Guarantee Temp. of —20° Outside | |

**EXPOSURE FACTORS**

| | | | |
|---|---|---|---|
| N | 1.20 | S | 1.00 |
| NE | 1.00 | SW | 1.10 |
| E | 1.00 | W | 1.20 |
| SE | 1.00 | NW | 1.20 |

| | Base Floor | | Interm'e Floor | | | Ceiling | | Partition | | | Type |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Conc. on Earth | Wood on Sleep. | 4" Conc. | 4" Conc. 3" Fill 1" Fin. | Double Wood | Lath and Plas. | L & P Wo. Fl. Over | Stud L & P 1 Side | Stud L & P 2 Side | | Kind |
| | | | | | | | | | | | Thick. |
| 0 | .31 | .13 | .20 | .15 | .20 | .49 | .28 | .60 | .33 | | K |
| 5 | 11.6 | 4.88 | 7.50 | 5.63 | 7.50 | 18.4 | 10.5 | 22.5 | 12.4 | | K(Ti-To) |
| 0 | 19.4 | 46.1 | 30.0 | 40.0 | 30.0 | 12.2 | 21.4 | 10.0 | 18.2 | | 1 |
| 0 | 38.8 | 92.2 | 60.0 | 80.0 | 60.0 | 24.4 | 42.8 | 20.0 | 36.4 | | 2 |
| 0 | 58.2 | 138 | 90.0 | 120 | 90.0 | 36.6 | 64.2 | 30.0 | 54.6 | | 3 |
| 0 | 77.6 | 184 | 120 | 160 | 120 | 48.8 | 85.6 | 40.0 | 72.8 | | 4 |
| 0 | 97.0 | 231 | 150 | 200 | 150 | 61.0 | 107 | 50.0 | 91.0 | | 5 |
| 0 | 116 | 277 | 180 | 240 | 180 | 73.2 | 128 | 60.0 | 109 | | 6 |
| 0 | 136 | 323 | 210 | 280 | 210 | 85.4 | 150 | 70.0 | 127 | | 7 |
| 0 | 155 | 369 | 240 | 320 | 240 | 97.6 | 171 | 80.0 | 146 | | 8 |
| 0 | 175 | 415 | 270 | 360 | 270 | 110 | 193 | 90.0 | 164 | | 9 |
| 00 | 194 | 461 | 300 | 400 | 300 | 122 | 214 | 100 | 182 | | 10 |
| 10 | 213 | 501 | 330 | 440 | 330 | 134 | 235 | 110 | 200 | | 11 |
| 20 | 233 | 553 | 360 | 480 | 360 | 146 | 257 | 120 | 218 | | 12 |
| 30 | 252 | 599 | 390 | 520 | 390 | 159 | 278 | 130 | 237 | | 13 |
| 40 | 272 | 645 | 420 | 560 | 420 | 171 | 300 | 140 | 255 | | 14 |
| 50 | 291 | 692 | 450 | 600 | 450 | 183 | 321 | 150 | 273 | | 15 |
| 60 | 310 | 738 | 480 | 640 | 480 | 195 | 342 | 160 | 291 | | 16 |
| 70 | 330 | 784 | 510 | 680 | 510 | 207 | 364 | 170 | 309 | | 17 |
| 80 | 349 | 830 | 540 | 720 | 540 | 220 | 385 | 180 | 328 | | 18 |
| 90 | 369 | 876 | 570 | 760 | 570 | 232 | 407 | 190 | 346 | | 19 |
| 00 | 388 | 922 | 600 | 800 | 600 | 244 | 428 | 200 | 364 | | 20 |
| 10 | 407 | 968 | 630 | 840 | 630 | 256 | 449 | 210 | 382 | | 21 |
| 20 | 427 | 1014 | 660 | 880 | 660 | 268 | 471 | 220 | 400 | | 22 |
| 30 | 446 | 1060 | 690 | 920 | 690 | 281 | 492 | 230 | 419 | | 23 |
| 40 | 466 | 1106 | 720 | 960 | 720 | 293 | 514 | 240 | 437 | | 24 |
| 50 | 485 | 1153 | 750 | 1000 | 750 | 305 | 535 | 250 | 455 | | 25 |

# How to Use the New Orleans Table

**Figure from the plans the number of square feet of wall, glass and lineal feet of crack for each exposure. Find the nearest corresponding quantity in appropriate column. Then read horizontally to extreme right- or left-hand column for square feet of radiation required. Add additional amount for exposure, as shown in upper right-hand square of data sheet.**

For example, for New Orleans: 70 sq. ft. of 12-in. brick wall. Read down the column headed "Plain brick, 12-in."; the figure in the table falls between 56.2 and 84.3. Following horizontally to extreme left or right shows about 2.5 sq. ft. of 38-in. 3-col. radiation. If wall faces north, multiply by 1.50, making 3.7 sq. ft. actually required.

If same wall has 30 sq. ft. of glass or door, the nearest corresponding figure, under "Glass," is 32.7, or 4.0 sq. ft. This figure multiplied by exposure factor 1.50, equals 6.0 sq. ft. If window has 39 lin. ft. and is double-hung wood sash, without weather strips, the nearest corresponding figure in the table (using the column headed "50" under "Infiltration") falls at 40.0, or the equivalent of about 4.0 sq. ft. of radiation. Multiplying by 1.50, for exposure, equals 6.0 sq. ft. of radiation.

The three quantities—3.7, 6.0 and 6.0—equal 15.7, or, for simplicity, 16 sq. ft. as the total radiation required for this exposure. The three quantities for any one exposure can be added together and then multiplied by the exposure factor to obtain the same result. No exposure factor is to be used for roofs, floors, ceilings, or partitions or skylights, unless skylights are vertical, or practically vertical.

The factor in the last column is the number of B.T.U. per lineal foot of crack per hour per degree difference in temperature.

# How to Use the St. Paul, Minn., Table

**Figure from the plans the number of square feet of wall, glass and lineal feet of crack for each exposure. Find the nearest corresponding quantity in appropriate column. Then read horizontally to extreme right- or left-hand column for square feet of radiation required. Add additional amount for exposure, as shown in upper right-hand square of data sheet.**

For example, for St. Paul, Minn.: 70 sq. ft. of 12-in. brick wall. Read down the column headed "Plain brick, 12-in."; the nearest corresponding figure in the table falls between 65.7 and 75.0. Following horizontally to extreme left or right shows 7.5 sq. ft. of 38-in. 3-col. radiation. If wall faces north, multiply by 1.20, making 9.0 sq. ft. actually required.

If the same wall has 30 sq. ft. of glass or door, the figure in the table under "Glass" is 30.0, or say, 11.0 sq. ft. This figure, multiplied by exposure factor 1.20, equals 13.2 sq. ft. If window has 39 lin. ft. of crack and is double-hung wood sash, without weather strips, the corresponding figure in the table (using the column headed "50" under "Infiltration") is 40.0, or 12.0 sq. ft. of radiation. Multiplying by 1.20, for exposure, equals 14.4 sq. ft. of radiation.

The three quantities—9.0, 13.2 and 14.4—equal 36.6, or, for simplicity, 37 sq. ft. as the total radiation required for this exposure. The three quantities for any one exposure can be added together and then multiplied by the exposure factor to obtain the same result. No exposure factor is to be used for roofs, floors, ceilings, or partitions or skylights unless skylights are vertical or practically vertical.

The factor in the last column is the number of B.T.U. per lineal foot of crack per hour per degree difference in temperature.

# St. Louis Hospitality at the Convention

## Pre-Convention at the Bevo Mill

A delightful get-together affair was arranged for the night preceding the meeting at the Bevo Mill, famous as a pre-prohibition resort in the outlying district of St. Louis. A party of 70 or more were taken out to the Mill in automobiles under the guidance of E. S. Hallett. After a delightful dinner, the chairman, M. C. Milligan, who is architect and supervisor of school buildings for the St. Louis schools, first called upon each guest to get up, announce his name and business connection. He then called upon many of them for a word of greeting. No one had come prepared to speak and the result was a medley of impromptu talks which soon had the guests on easy terms of familiarity with each other and with their hosts.

Everything was discussed, from the new activities of the New York State Commission on Ventilation to the relative merits of Philadelphia, New York, Chicago and St. Louis. As Mr. Hallett expressed it afterwards, everything of importance that was to come before the society had been handled with tact and dispatch to the satisfaction of everyone concerned, so that the society's business sessions were really quite superfluous.

The party broke up at a late hour with the declaration by more than one of the guests that it had been a delightful means of "breaking the ice" for the convention itself.

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Under the leadership of E. B. Langenberg, the local Committee on Arrangements carried out an entertainment program which proved highly enjoyable. On the first day of the meeting the ladies were taken on an automobile trip and shown the beauty spots of St. Louis. The party brought up at the Coronado Hotel where luncheon was served. In the afternoon the ladies played bridge at the Coronado. The same evening an informal dance was staged at the Hotel Statler.

Practically all of the members and guests attended the annual dinner of the society, which was held Thursday evening in the main ball-room of the hotel. President William H. Driscoll acted as toastmaster and the principal speaker of the evening was Former Senator Xenophon P. Wilfley of Missouri.

Seated at the guests' table were President Driscoll, the incoming president, Dean Anderson, Professor A. C. Willard, Director F. C. Houghten, H. P. Gant, E. B. Langenberg, Thornton Lewis, Homer Addams, Professor S. E. Dibble and A. E. Humphreys, president of the St. Louis Chapter.

Before the speechmaking began, William E. Sodemann, on behalf of the St. Louis Chapter, presented the toastmaster with a silver-mounted gavel, suitably engraved, signifying the chapter's loyalty and devotion to the society.

E. B. Langenberg was called upon to introduce Senator Wilfley and took advantage of the opportunity to introduce the local committee chairmen, including V. D. Rossman, finance; E. A. White, transportation; William C. Sodemann, program and publicity; J. M. Foster, entertainment; A. E. Humphreys, hotel; C. A. Pickett, automobiles; and last and best, as he expressed it, Mrs. R. E. Graves, ladies. Each one was given a hearty round of applause.

Senator Wilfley spoke on the topic of "Good Ethics in Business." He made a forceful presentation in which he lauded the ethical standards set by the society as being in accord with the splendid ideals which are being set before the business world.

Following the senator's address, Dean Anderson, in a warm tribute to the retiring president, William H. Driscoll, presented him with a past-president's emblem. As Mr. Driscoll arose to respond, he was acclaimed by the assemblage. He acknowledged the tribute with a depth of feeling which indicated his appreciation to the full of the honors conferred upon him. In the course of his remarks he declared that the society had meant much to him in his professional activities, was indeed his alma mater.

This brought the formal program to a close and the hall was then cleared for dancing, which continued until a late hour.

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## Past Presidents' Dinner

In accordance with a well-established custom, all of the former presidents of the society who were in St. Louis held a meeting of their own at the Hotel Statler, Wednesday evening. Dinner was served in the Adam Room and the remainder of the evening was spent in an atmosphere of delightful reminiscence and sociability.

Those in attendance were Reginald Pelham Bolton, New York; J. H. Kinealy, St. Louis; John F. Hale, Chicago; Samuel R. Lewis, Chicago; J. Irvine Lyle, Newark, N. J.; Harry M. Hart, Chicago; H. P. Gant, Philadelphia; J. R. McColl, Detroit; Homer Addams, New York; and Professor S. E. Dibble, Pittsburgh.

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## Meeting of Manufacturers' Association

The presence of so many fan men and unit heater men at St. Louis led to special meetings of the National Association of Fan Manufacturers and of the Association of Unit Heater Manufacturers, at which were discussed many of the developments brought out during the course of the society's meeting.

New officers of the Unit Heater Manufacturers' Association were elected with Thornton Lewis, York Heating and Ventilating Corp., president; William J. Mauer, Dwyer Equipment Co., Chicago, vice-president, and Judge Cresap, Chicago, secretary-treasurer.

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## New York Chapter Discusses Chimney Construction

"Chimney Construction and Draft Consideration" furnished a topic for lively discussion at the January meeting of the New York Chapter, held at the Building Trades Club, in New York, January 17.

A paper on this subject was presented by Ira A. Woolson, consulting engineer, National Board of Fire Underwriters, and was illustrated by numerous slides. Mr. Woolson went into the requirements of good chimney construction and explained the alterations in the Underwriters' rating table as applied to chimneys of various sizes and shapes. Mr. Woolson's assistant, F. H. Alcott, then took up the subject of how and why the various ratings for different shapes and construction of chimneys had been developed.

At the conclusion of the talk, D. Knickerbacker Boyd, architect, of Philadelphia, gave, in a few words, the architect's view of the desirability of improvement in chimney construction. A protracted discussion ensued on the matter of whether smoke should be considered as travelling up the chimney with a spiral motion, with straight motion or with a rolling movement.

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## Illinois Chapter

"Tests to Determine Air Elimination from Hot-Water-Type and Steam-Type Radiators in Single-Pipe Heating Systems" was the title of a paper presented by C. W Bronson, at the January meeting of the Illinois Chapter, held January 11 at the Hotel Sherman, Chicago. Pamphlets were distributed showing tests for air elimination made by the Kewanee Boiler Company. These tests were published in THE HEATING AND VENTILATING MAGAZINE for May and June, 1926.

For the Committee on Public Relations, Chairman Cliff W. Presdee, western manager of THE HEATING AND VENTILATING MAGAZINE, announced a series of radio talks, which were to be broadcast from Station WQJ, Chicago. The subjects and speakers are as follows:

January 20. "Better and Guaranteed Heating Service for Home Owners," by Harry M. Hart.

January 27. "Oil Burners in the Home," by E. H. Fahey.

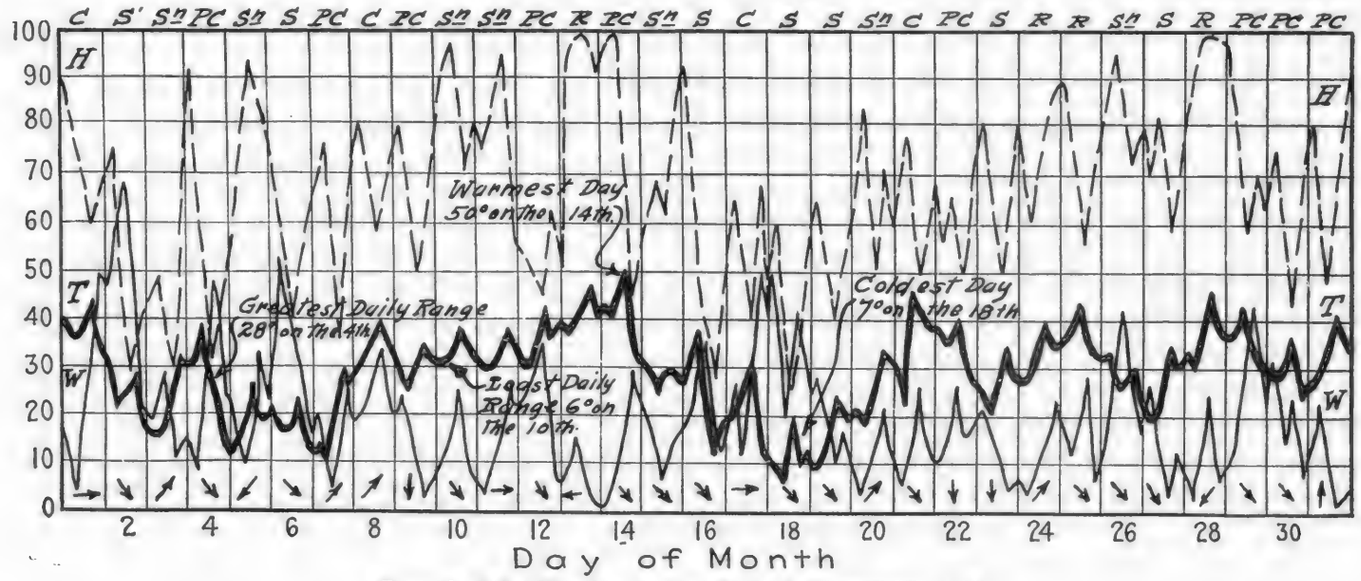
February 3. "My Insulated Home," by H. S. Ashenhurst.

February 10. "Heat Regulation in the Home."

After the reading of the paper by Mr. Bronson considerable discussion on boiler ratings developed.

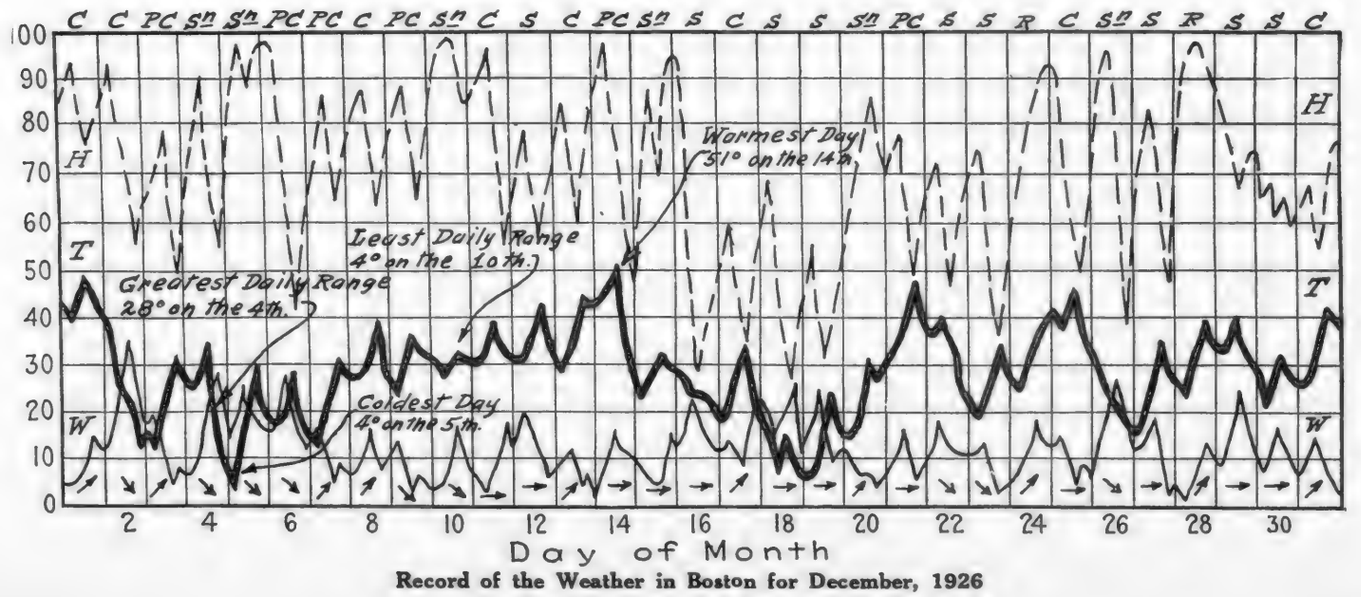
# The Weather for December, 1926

| | New York | Boston | Pittsburgh | Chicago | St. Louis |
|---|---|---|---|---|---|
| Highest temperature, deg. F. | 50 | 51 | 60 | 51 | 67 |
| Date of highest temperature | 14 | 14 | 13 | 13 | 3 |
| Lowest temperature, deg. F. | 7 | 4 | 7 | —3 | 6 |
| Date of lowest temperature | 18 | 5 | 18 | 15 | 15 |
| Greatest daily range, deg. F. | 28 | 28 | 26 | 46 | 45 |
| Date of greatest daily range | 4 | 4 | 14 | 13 | 13 |
| Least daily range, deg. F. | 6 | 4 | 2 | 2 | 5 |
| Date of least daily range | 10 | 10 | 9 | 9 | 25 |
| Mean temperature for month, deg. F. | 29.2 | 28.6 | 31.6 | 26.6 | 33.4 |
| Normal mean temp. for month, deg. F. | 35.0 | 32.4 | 34.2 | 28.8 | 34.9 |
| Total precipitation, this month, in. | 3.72 | 3.96 | 3.12 | 0.87 | 1.15 |
| Total snowfall, this month, in. | 10.2 | 29.2 | 4.4 | 5.5 | 2.0 |
| Normal precipitation, this month, in. | 3.45 | 3.41 | 2.73 | 2.07 | 2.23 |
| Total wind movement, this month, miles | 12889 | 7904 | 8787 | 9515 | 9368 |
| Average hourly wind velocity, miles | 17.3 | 10.6 | 11.8 | 12.8 | 12.6 |
| Prevailing direction of wind | N.W. | W. | S.W. | N.W. | N.W. |
| Number of clear days | 7 | 13 | 2 | 8 | 11 |
| Number of partly cloudy days | 12 | 10 | 4 | 6 | 1 |
| Number of cloudy days | 12 | 13 | 25 | 17 | 19 |
| Number of days with precipitation | 14 | 11 | 17 | 8 | 8 |
| Number of days with snow | 12 | 8 | 8 | 4 | 2 |
| Snow on ground at end of month, in. | Trace | 1.7 | 0.9 | Trace | None |

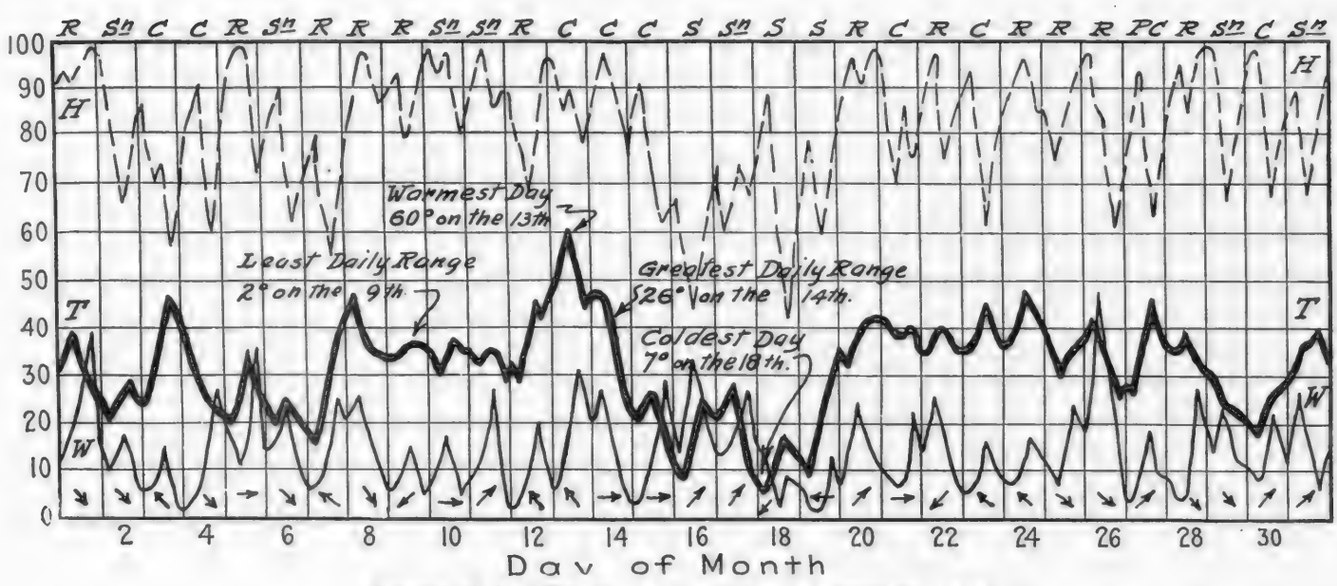

Warmest Day 50° on the 14th.
Greatest Daily Range 28° on the 4th
Least Daily Range 6° on the 10th.
Coldest Day 7° on the 18th
H
T
W
Day of Month

**Record of the Weather in New York for December, 1926**

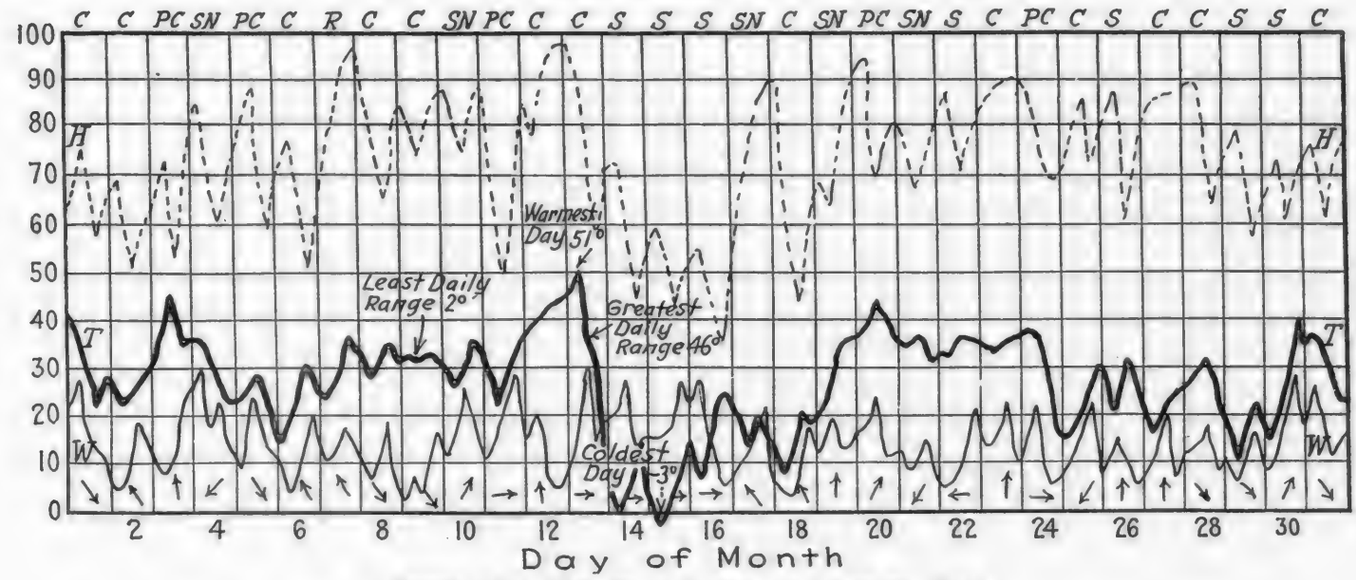
(Hourly Observations of the Relative Humidity Plotted on this Chart)


Warmest Day 51° on the 14th.
Least Daily Range 4° on the 10th.
Greatest Daily Range 28° on the 4th.
Coldest Day 4° on the 5th.
H
T
W
Day of Month

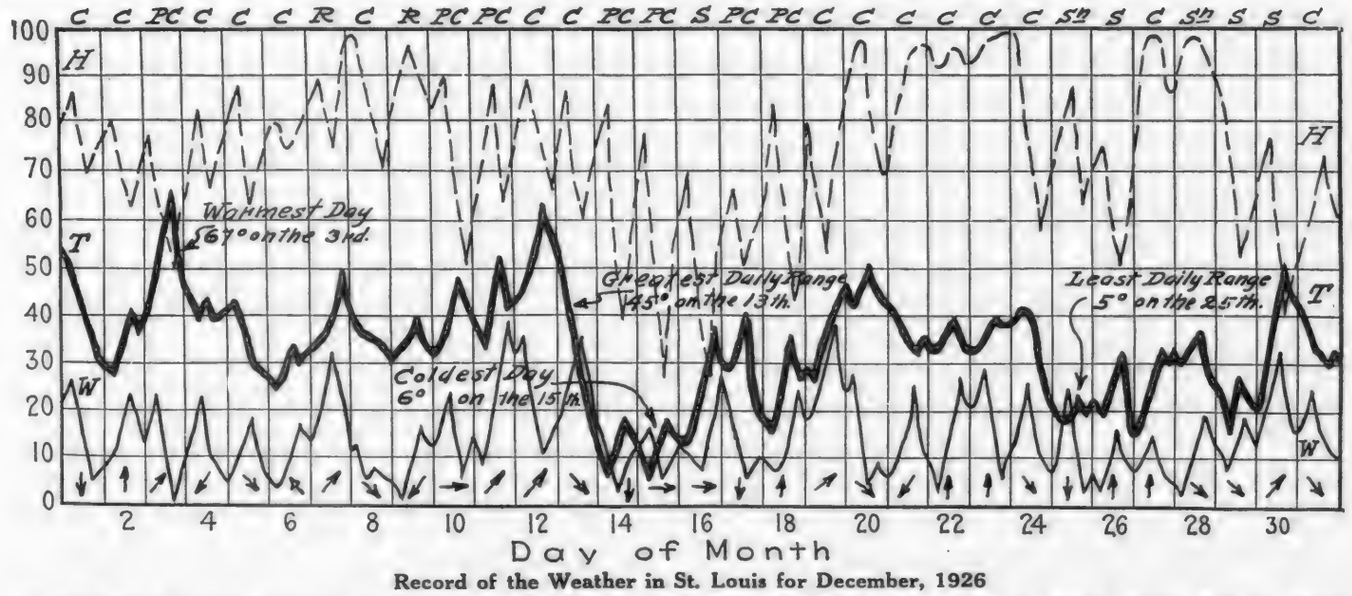
**Record of the Weather in Boston for December, 1926**


R Sn C C R Sn R R R Sn Sn R C C C S Sn S S R C R C R R R PC R Sn C Sn
100
90
80
70
60
50
40
30
20
10
0
H
T
W
Warmest Day 60° on the 13th
Least Daily Range 2° on the 9th
Greatest Daily Range 26° on the 14th
Coldest Day 7° on the 18th
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Day of Month

**Record of the Weather in Pittsburgh for December, 1926**




**Record of the Weather in Chicago for December, 1926**


C C PC C C C R C R PC PC C C PC PC S PC PC C C C C C C Sn S C Sn S S C
100
90
80
70
60
50
40
30
20
10
0
H
T
W
Warmest Day 67° on the 3rd.
Greatest Daily Range 45° on the 13th.
Least Daily Range 5° on the 25th.
Coldest Day 6° on the 15th.
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Day of Month

**Record of the Weather in St. Louis for December, 1926**

Plotted from records especially compiled for THE HEATING AND VENTILATING MAGAZINE by the United States Weather Bureau.
Heavy lines indicate temperatures in degrees F. Light lines indicate wind in miles per hour.
Broken lines indicate humidity in percentage from readings at 8 A.M., 12 M., and 8 P.M.
S—Clear, PC—partly cloudy, C—Cloudy, R-rain, Sn—snow. Arrows fly with prevailing directions of wind.

# Correspondence

*Conducted by T. W. Reynolds*

## Maximum Length of Runouts Without Bleeders

EDITOR HEATING AND VENTILATING MAGAZINE:

How far can a branch from the main be run without using a bleeder to drip it at the end?

Paterson, N. J. J. K.

In tall buildings, say over five or six stories high, all branches to risers are pitched toward the riser and dripped at the riser base. The amount of returning condensate is much greater, in such cases, but of far greater importance than this factor is the probability that any runout graded back to the main might buckle upward in the middle or have its grade reversed by the expansion of a tall riser, thereby pocketing water at the riser end.

For other work the Chicago Master Steam Fitters' Association use the following rule:—Branches 8 to 12 ft. long must be made one size larger, 12 to 18 ft. long two sizes larger and over 18 ft., a bleeder must be used. In the first two cases the branch must be given a good pitch back to the main. These are rule-of-thumb methods which, in the absence of test data, have been widely used with a fair measure of success.

In the past it was necessary to apply various factors of safety in order to discount those things of which but little was known, but within the last few years the results of certain tests have upset some preconceived theories and established a distinct progressive step in our knowledge of what takes place inside of the pipes. Heretofore runouts have been sized mainly on the basis of pressure-drop or friction to the flow of steam within the pipe, factors, however, which seem to apply more properly to the mains and risers. For example, in runouts the condition is more usually one of counter-flowing condensate in a pipe nearly horizontal. Thus, flow of steam in the opposite direction produces waves at the surface of the condensate, due to the friction between the steam and returning condensate. The greater the waves, the greater the friction until, with increase in wave motion up to a certain point, the effective area of the pipe becomes so reduced in amount that the velocity of steam sweeps the condensation backward to the riser.

As a result of the tests referred to, it has been determined that the length of the runout has no appreciable affect if the pitch is over 4 in. per 10 ft. of length, though with lesser grades in runouts over 10 ft. long, the amount of radiation served by the runout must be decreased 6% for each 10 ft. of increase in length over 10 ft. However, if the capacity or pitch of the pipe is too small, the velocity of steam will sweep the condensation to the high end of the runout, irrespective of its length, whether short or long.

From this it will be seen that size and slope of pipe are of more importance than its length and that, when given a full measure of each, no bleeders are required. The larger the pipe, especially above the 2-in. size, the less pitch that is required; thus, a large pipe with a small pitch is better than a small pipe with a greater pitch. Pitches up to 4 in. per 10 ft. of pipe length are of considerable help in increasing the amount of radiation which a given size of runout will serve, as well as in effecting proper drainage of the pipe, but any increase in grade above this has no appreciable effect.

The flow of steam is most likely to sweep the condensation up the vertical riser pipe during the heating-up period, at which time the demand for steam is the greatest, but in buildings where the resulting noise is not so objectionable the grade of the runouts can be materially lessened, as the noise would be of short duration. In such cases the grade for a properly-sized runout, up to 10 ft. long, need be only ⅜ in. in 10 ft. on two-pipe work and 1 in. in 10 ft. on one-pipe work. However, in average practice grades of 1-in. and 1½-in., respectively, are commonly used.

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## Heating Garage Near Water-Level of House Boiler

EDITOR HEATING AND VENTILATING MAGAZINE:

As a reader and subscriber of your magazine I want to ask a question in the hope you will help me out. I am a steamfitter and am used to larger jobs of heating, but on small house work a lot of little points come up sometimes which are puzzling.

I expect very soon to do two one-family houses of the better type, these being arranged for one-pipe steam heating.

Recently the owner has decided to build a garage and wants it heated. The floor will be but little higher than the boiler water-line and the information wanted is a sketch of one or two feasible schemes showing how the garage radiator can be hooked up to the house boiler.

The garage will be 20 ft. to 25 ft. from the house.

Long Island, N. Y. J. P. B.

While long-distance engineering advice is not always easy to give in a way to be of real value to the inquirer, anyone writing in can be sure of receiving all the help it is possible to extend without actually looking over the job and testing out the operation of same.

Our correspondent says he is to have a one-pipe steam system and, therefore, the pipe extending to the garage must be arranged to connect up with such a system as it might be laid out in the house. Fig. 1 represents the rear of the house, the front of the garage and the intervening space of 20 ft. to 25 ft.

In the ordinary residence the cellar floor is usually 4 ft. to 5 ft. below grade, and standard steam boilers with ratings up to 1200 sq. ft. are procurable with a 44½ in. water-line. The distance of the water-line below the low end of the steam line (under the radiator in the garage) should not be less than 12 in. To reduce this to a smaller figure is only to court trouble later.

In crossing the yard a grade of at least ⅛ in. per foot should be maintained so as to drain the line to the return connection under the garage radiator. For the return line it is best to keep it at least 12 in. under the water line and, better yet, under the frost line, which seldom goes over 4 ft. below grade. The return may be run flat but a little pitch toward the boiler will permit draining out this line through the drain cock when desired.

Starting with a boiler water-line of 3 ft. 8½ in. and adding 12 in. to the low

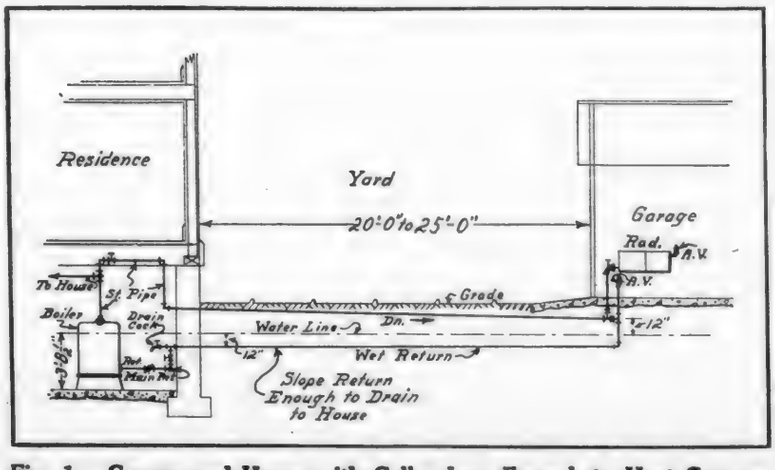



**Fig. 1. Garage and House with Cellar Low Enough to Heat Garage**

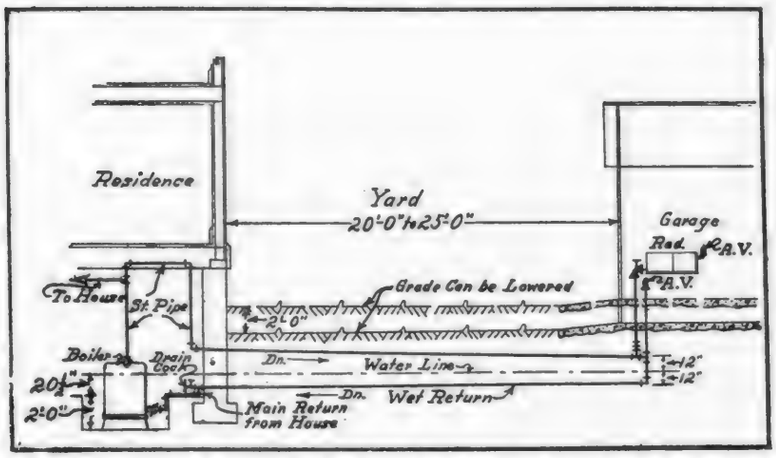



**Fig. 2. Garage and House with Cellar Requiring a Boiler Pit to Heat Garage**

point of the steam line, and 3 in. for pitch up to the high end, and 12 in. more for cover on the top of the steam-pipe, the distance from the cellar floor to the grade line is found to be

3 ft. 8½ in. + 12 in. + 3 in. + 12 in. = 5 ft. 11½ in., or practically 6 ft.

Now if the cellar floor is not 6 ft. below grade only two solutions remain:—either to pit the boiler (until this 6 ft. difference is obtained) or, possibly, to find a boiler with a lower water-line.

Fig. 2 shows the conditions when the boiler is pitted 24 in., the arrangement in this case making it possible to either secure 24 in. more cover over the pipe, to raise the steam line 24 in. higher above the water-line than shown in Fig. 1, or, lastly, to accommodate a grade line only 4 ft. above the cellar floor, but 6 ft. above the floor of the boiler pit.

Of course, other alternatives exist, such as putting in a small automatic receiver-return-pump, or using a thermostatic trap on the end of the return line and allowing the return to waste to the sewer. Both of these schemes, however, have objections for residence work owing to the fact that the first scheme requires an uninterrupted supply of electric current and an absolutely dependable automatic apparatus to control; the second scheme will in time drain the water out of the boiler or may cause damage to the drain pipe by the expansion resulting from injecting such excessively hot water directly into the drain line.

Be sure to have your steam pipe to the garage of ample size, at least one or two sizes larger than you would use for a similar-sized radiator if located in the house. This will do much to avoid the excessive drop in pressure at the end of the line and the flooding which might otherwise result. Also be sure to air-vent the end of the steam line just before it drops down into the wet-return connection.

It will be necessary to cover the steam line with some type of water-proof insulation. Hair felt, jacketed with two or three thicknesses of building paper and double wrapped with tar paper thoroughly pitched is probably as good as anything outside of patented insulation. The pipe must be also kept free for expansion and a 6-in. or 8-in. tile pipe is very good for this; split-tile conduit is also obtainable.

If run below the frost line, it is only necessary to bury the return in sand so as not to allow the earth to grip the pipe. The sand will also act as an insulator.

## Why Water Leaves the Boiler

EDITOR HEATING AND VENTILATING MAGAZINE:

Enclosed is a blueprint (Fig. 1) which I believe will illustrate what I want to ask. This boiler is installed as shown. The trouble is with the water leaving the boiler.

The installation was at first made with two 4-inch risers out of the front and middle tapped sections. The header arrangement was added later in an effort to prevent the condition mentioned. The system has two dry returns, as shown, with swing-check valves installed where the returns run horizontal just before entering the return tappings.

These checks are in good working condition. To further make sure that the water was not leaving via the returns we disconnected them in the drop to the return taps and installed gate valves, opened slightly to allow for the condensation drip. With the water in the gage showing approximately a full glass we raised a pressure of 3 lbs. In a few minutes the water left the glass entirely. Upon opening the gate valves wide, a full stream of water came through.

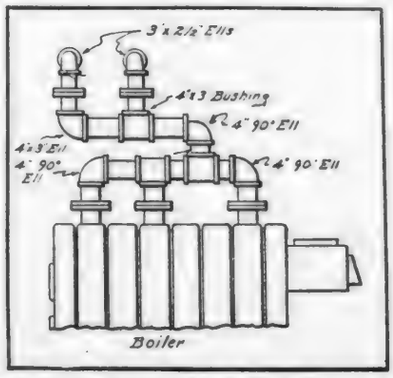



**Fig. 1. Sketch of Boiler Connections Submitted by Correspondent**

Obviously, the water is going through the header. All radiator valves are wide open and the air valves in good condition. All pipes are pitched properly and of the sizes shown. I would appreciate an opinion of the cause and the remedy for this condition.

Chicago, Ill. H. R.

While the method of piping shown is rather unusual, there is nothing indicated which should cause any trouble from water going over into the mains. If you are having trouble with a system that is but recently installed, we feel sure it must come from oil, grease and dirt in your boiler water.

Assuming that what you say (regarding the water not leaving the boiler through the return connection) is correct, then it must be leaving through the steam line and this could only occur by foaming or priming.

We would suggest that you give the boiler the good old washing soda treatment which has cured twice as many boiler ills as were ever caused by piping. This consists of:

(a) Mix 5 lbs. of common washing soda with sufficient water to dissolve it.
(b) Let steam pressure go down to zero and remove safety valve.
(c) Pour in the solution and replace valve.

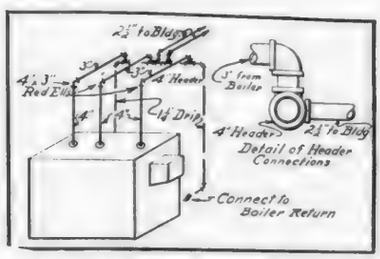



**Fig. 2. Changes Suggested in Boiler Connections to Eliminate Water Leaving Boiler**

(d) Let the water boil (without raising any steam pressure) for three or four hours.
(e) Then let the fire go out and drain off the boiler absolutely dry. Refill up to safety valve tapping level with fresh, cold running water.
(f) Then drain off the water absolutely dry.
(g) Refill a second time and light slow fire until steam pressure begins to show.

This is a very cheap experiment to try and if your trouble is due to boiler water, it will stop at once. The accumulation of additional oil and dirt in the boiler may require this washing-out process to be repeated at later intervals; sometimes four or five washings are necessary during the first winter a system is in operation.

We think this will solve your difficulty and if it does not, then we would suggest your going to the expense of altering your steam main. If possible,

the best way to do this would be to run full size pipe (as shown in Fig. 2) from all your 4-in. boiler outlets, with 4-in. pipe carried as high as possible against the ceiling and then turning horizontally with 4-in. x 3-in. reducing elbows, connecting the 3-in. outlet of the elbows to 3-in. ells, looking down, there being a 3-in. nipple of 2 ft. or 3-ft. length between the ells.

The 3-in. ells looking down should connect through a short nipple and 4-in. x 3-in. tees with a 4-in. steam header which can be dripped at each end through 1¼-in. pipe back into the boiler return tappings. The two 2½-in. mains should leave this header through two 4-in. x 2½-in. tees looking up and connecting with a short nipple and 2½-in. ells, looking horizontally, to which the two 2½-in. mains can be connected.

## Comparative Air Elimination and Proper Height of Air Valve for Steam and Water-Type Radiators

EDITOR HEATING AND VENTILATING MAGAZINE:

May I have an answer to the accompanying question?

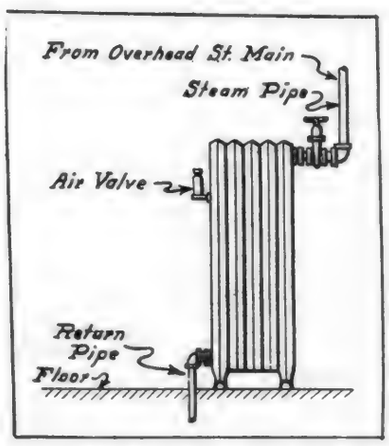



**Fig. 1. Air Valve as Now Installed on Radiator with Top Supply Connection**

In the sketch enclosed (Fig. 1), air cannot be eliminated from radiator. Will arrangement shown in Fig. 2 work?

I do not see where dropping the inlet to the bottom of the radiator will help, as steam will naturally pass quickly through top nipple ports to the air valve, thus closing it.

Is this an inherent fault of hot water radiation where automatic air valves are required?

Fort Wayne, Ind. B. J. M.

That the correspondent is correct in his premises regarding the proper location of the air valve has been shown by tests as conducted in the A.S.H. & V.E. laboratory and the Kewanee Boiler Company. (See THE HEATING AND VENTILATING MAGAZINE for May and June, 1926). Many preconceived notions were upset as a result of these tests. For example, it was thought that the steam

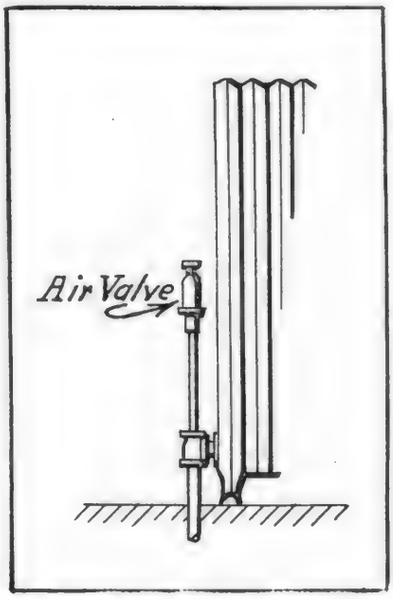



**Fig. 2. Change Suggested by Correspondent to Rectify Air Binding in Radiator**

would reach the air valve sooner with the water-type radiator, through the top nipple connections, thereby closing the air valve and preventing complete air elimination. The tests indicate that this is not true, or, rather, that it is true only when the position of the air valve is *25½ in. above the floor.

Complete air elimination was obtained in water-type radiators with the air valve located 15½ in. or less above the floor, lower positions being better in this respect; thus, for air valve heights in inches of 25, 15½, 9½ and 5, the time in minutes required to reach constant temperature conditions was 40, 25, 22 and 21, respectively. In the same order of heights, steam-type radiators required 27, 28, 32 and 35 minutes, higher positions of the air valve up to and including 25½ in. being more effective. Furthermore, complete air elimination was not obtained, air being trapped in the lower part of the last section.

The rate of heating was more rapid for the water-type radiator, temperature readings showing that the entering steam rose almost immediately in the first sections to the upper header, from which point it was then distributed to all other sections.

In one test of the series the top connection between two end sections of a water type radiator were plugged in order to prevent steam from entering the last section from the top, but only slight benefit was derived, the time interval being 20 minutes, as compared with 25 minutes when the section was not plugged.

The above tests were made by the Kewanee Boiler Company on 19-sec. 3-col., 38-in. high radiators, having 1½ in. *one-pipe* connections. Tests at the A.S.H. & V.E. research laboratory on 20-sec. 3 col., 45-in. high radiators having 2-in. one-pipe connections and two-pipe bottom connections (gravity and vapor) gave similar results. In the case of both steam and water type having 2-in. one-pipe, and two-pipe bottom gravity connections, all sections of the radiators were hot and the air valve closed at the end of 35 minutes, whereas heating with vapor (two-pipe bottom connections) was more rapid, the time interval being only 20 minutes for the steam-type radiator and still less, or 15 minutes, for the water type.

For a study of the above data, as summarized from the tests, it will be seen that the best position of the air valve on the water-type radiator in question should be about 5 in. above the floor. It may also be said that the question of entering velocity of the steam as affecting premature closure of the air valve (due to short distance from entrance to air valve) does not hold true in this case, or in any case of gravity heating where the air has to be compressed in order to drive it through the pin hole of an air valve. Practical observations on the slow heating of radiators, as made by sense of heat to the hand, will soon prove the point.

In vapor and particularly in vacuum heating, the conditions are somewhat different. For example, it is known that bottom connections at opposite ends and *top and bottom connections on the same end should not be used in these systems, because the inherent quick-venting qualities of such systems eliminate any air cushion tending to arrest the entrance velocity of the steam. Hence, steam may short circuit to the thermostatic member of the return trap and close it prematurely.

*Standard air valve height on steam-type radiators.

*This method is not so objectionable where the radiator is no longer than its height.

## Sturtevant Uses Fan Industry to Predict Future Business Conditions

That the so-called air-conditioning and blower index is a good indicator of what may be expected in business conditions of the country for the near future was told the National Association of Fan Manufacturers at their recent convention by E. B. Friedman, of the B. F. Sturtevant Co., Hyde Park, Mass.

Mr. Friedman, who is also president fo the Association, stated that he considered the sales of fan, blower and air-conditioning apparatus as a better indicator of future business than steel tonnage, pig iron production or blast furnaces in operation. After outlining various reasons for this conclusion, Mr. Friedman went on to state:

"In the light of present conditions, what does the fan and blower business indicate for general business in the future? It indicates a general slowing down during the late fall and winter that is expected to last for 90 to 120 days. It suggests conservatism on the part of the business man in any line. But, just as positively, this index indicates a renewal of activity in the spring and should begin to make its influence felt by early March."

# First Authentic Facts Portray Oil Burner Industry

## Accurate Figures Show 1926 Installations and Gross Value. Estimates Indicate Greatly Increased Volume of Business for 1927

DOMESTIC MECHANICAL DRAFT OIL BURNER STATISTICS, 1926-7

A. B. C.
Aetna
Aladdin
Baker
Berryman
Caloroil
Electrol
Grant
Hardinge
Hart
Johnson
Kleen Heet
Marr
Nokol
Nu-Way
Oil-O-Matic
Petro
Ray
Socony
Sundstrand
Super Oil
Sword
Timken-Detroit
Wayne

| Units Installed in 1926 | Gross Installed Value 1926 | Estimated Units to be Installed in 1927 | Estimated Gross Value Units Installed in 1927 | Estimated Increase 1927 over 1926 |
|---|---|---|---|---|
| 72,682 | $60,328,000 (Note 1) | 135,450 | $113,175,000 | 88% (Note 2) |

(1) Estimated Part of Total 1926 Business Represented by These Manufacturers .....93%

(2) Based on installed value.

THE data presented herewith provide the first authentic picture of the oil-burner industry that has been available. Such information has been wanting since the appearance of the oil-burner industry as an entity, but business jealousies and other causes have prevented many manufacturers from giving out accurate figures. As the president of one of the largest manufacturing concerns put it: "I hesitate in giving out such facts and figures as you have asked for, due to the fact that the sales people (not the principals) get hold of them and use them improperly."

For nearly two years THE HEATING AND VENTILATING MAGAZINE has endeavored to convince the Census Bureau and the Departments of Commerce and Labor that the compilation of such information, and many supplementary statistics, would be of value to the heating industry as well as to the manufacturers classified in other lines, but with overlapping interests. As one result of these efforts there was included in the 1926 manufacturers' census some questions designed to bring out pertinent facts. To date, however, the returns have been far from satisfactory in completeness. Obviously the omission of data from one or two important manufacturers from such census may seriously impair its value.

The figures from which these compilations were made were secured by telegraph, mainly from the chief executives of the several organizations. Only one declined to give the information requested and one was unable to develop the figures in the limited time available. In almost every instance the figures represent actual installations made, not gross factory sales or shipments. The money value of the sales made was secured by taking the aggregate of the net installations made by each manufacturer multiplied by the figure set by that manufacturer as representing a fair average of the country-wide installed cost of his burner.

The data on estimated sales for 1927 are, of course, purely estimates, yet in carefully studying each individual estimate in the light of past sales, company solidarity and other factors, not one could be rejected as probably excessive.

In accepting these figures certain facts must be kept in mind. Approximately twenty-five manufacturers are represented and it is thought that these are responsible for the great bulk of oil burner production. Many wild statements have appeared in the past as to the "thousands" of oil-burner manufacturers. There are not "thousands" or even "hundreds" of oil-burner manufacturers. The man who makes up a few burners, goes out and sells and installs them, and repeats the cycle is not, in any real sense, a manufacturer. While no exact line of demarcation exists between this class and the big producer, it is obvious that the burners that go through on a production basis constitute the bulk of the installations.

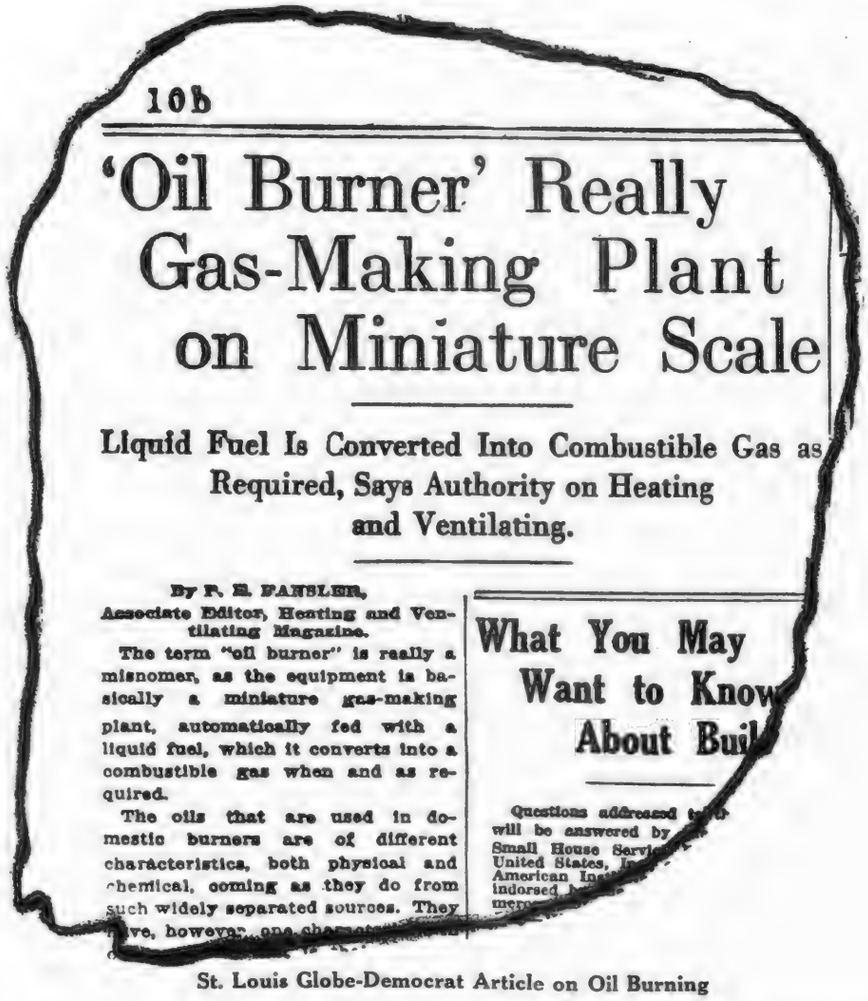
Each manufacturer represented in this list has made an individual estimate of the relation the volume of business done by the manufacturers here listed bears to the total amount of business done by all manufacturers of mechanical draft burners. The average of these estimates is given in the tabulation.

GRAVITY BURNERS NOT INCLUDED

Again it must be remembered that this analysis does not include the gravity burner class. There are many small manufacturers of this class of burner; many burners are so unsatisfactory that they are taken out at the end of the first season; sales are by mail, with no contact between factory representatives and user, and, taken as a class, gravity burners cannot be considered with their more elaborate cousins. This is not in any sense a disparagement of the type, as there are first-class gravity burners available, and there are many homes that can be handled with such burners with economy, safety and freedom from trouble. But they simply don't belong with the mechanical-draft burners for the purposes of this analysis.

For obvious reasons no individual figures are given. The exact sales figures of any manufacturer are his business, not that of the public. The aggregate data are of interest to the public, of value to the industry as a whole and to those over-lapping industries, such as the electric motor manufacturers, the pump, tank, and so-on, builders, and for these reasons they have been gathered together and presented.

THE HEATING AND VENTILATING MAGAZINE desires to publicly express appreciation of the hearty spirit of co-operation that prompted the executives of these companies to make available the confidential figures that go to make up this compilation.



10b

'Oil Burner' Really Gas-Making Plant on Miniature Scale

Liquid Fuel Is Converted Into Combustible Gas as Required, Says Authority on Heating and Ventilating.

By P. E. FANSLER,
Associate Editor, Heating and Ventilating Magazine.

The term "oil burner" is really a misnomer, as the equipment is basically a miniature gas-making plant, automatically fed with a liquid fuel, which it converts into a combustible gas when and as required.

The oils that are used in domestic burners are of different characteristics, both physical and chemical, coming as they do from such widely separated sources. They have, however, one characteristic

What You May Want to Know About Bui

Questions addressed to ... will be answered by ... Small House Service ... United States, ... American In... indorsed ... mem...

St. Louis Globe-Democrat Article on Oil Burning

## Newspapers Want Authentic Oil-Burner Information

An evidence of the desire of important daily papers throughout the country to present to their readers accurate information on the subject of domestic oil-burners is found in the request of the *St. Louis Globe-Democrat*, one of the notable papers of the Middle-west, to P. E. Fansler, associate editor of THE HEATING AND VENTILATING MAGAZINE for a series of articles on this subject. The first appeared under a title designed to dispel many of the fuzzy ideas as to just what an oil burner does do. It is Mr. Fansler's idea that, if all oil-burner salesmen unite in presenting a simple and accurate story of the functioning of an oil-burner, using words of one syllable and eliminating all of the coined words that mean nothing, there will be a material decrease in sales resistance.

This article told the story in such a simple and accurate way that it resulted in a hearty letter of commendation from the chief executive of one of the most important oil-burner manufacturers.

## Boston Better Business Bureau Warns Against "Free" Fire Extinguisher Scheme

In a circular recently enclosed with a report from the National Fire Protection Association, the Boston Better Business Bureau directs attention to a sales promotion scheme that evidently has been briskly pushed in New England territory, by representatives of the Tetrine Chemical Company, 1819 Broadway, New York.

This purports to be a "free" fire-extinguisher distribution, in which a "nominal" charge is made for the filling material of the extinguisher on the representation that the extinguisher has a retail value of $10. The bureau report indicates that the represented values are not inherent in the goods, that agents report difficulty in getting their orders filled, and, in general, that the scheme had better be left alone.

## Chicago Oil Burner Association

Thirty-eight members and guests of the Chicago Oil Burner Association participated in the January meeting and luncheon at the Allerton Club, Tuesday, January 11. Announcement was made by E. P. Fahey, of the Publicity Committee, of a series of radio talks through Station WQJ as given elsewhere in this issue in the report of the January meeting of the Illinois Chapter A.S.H.&V.E.

Homer Linn, of the American Radiator Company, reported to the association the great interest taken in the oil-burning industry by the American Petroleum Institute as evidenced in its last convention. Mr. Linn stated that specifications for oil fuel were discussed by the members although no standard specifications were adopted.

Stephen Andros, founder member of the association, told the members that a series of eight folders, which he had prepared for the American Oil Burner Association for use in connection with their publicity campaign, was available to the Chicago association. This campaign is of an educational nature and is intended to bridge the gap between the formative stage of the industry and the competitive stage into which it is now plunged.

C. E. Beery, of the Kewanee Boiler Company, who was the guest speaker, asked members of the association who are engaged in selling oil burners to do everything possible to eliminate the over-selling that has characterized the present sales efforts, particularly in the Chicago territory. The members were asked for suggestions for a slogan.

# Grates for Burning Small-Sized Anthracite

*Previous articles in this series are as follows:*

1.—*Neemes, October*, 1926.
2.—*Johnson, November*, 1926.
3. *Rath, November*, 1926.
4.—*Pyramid, December*, 1926.
5.—*Culm-Burn, December*, 1926.
6.—*Atlas, January*, 1927.

## 7. Spencer Heater

ALTHOUGH having a special grate arrangement for burning small sizes of anthracite coal, the Spencer heater, made by the Spencer Heater Co., Williamsport, Pa., has so many other special features as to make it fall entirely outside of the classification simply of grates. It is much more than a grate, it is a whole apparatus.

A description of the construction of the Spencer heater is necessarily complicated, owing to the unusual features involved and the novel ideas utilized. In the first place, the heater is of magazine type and has a coaling capacity considerably in excess of the ordinary boiler. Under ordinary weather conditions, coaling every 12 hrs. is ample, while in extremely mild weather, the heater will sometimes carry 24 hrs. without replenishment. In extreme weather with the heater fully loaded, coaling at more frequent intervals is necessary, this condition occurring only a few times during the season.

**Fig. 1. Spencer Steel Tubular Boiler**

TUBULAR HEATER

The heater, of steel tubular construction, has two cast-iron headers or sections—one forming the front of the boiler and the other the rear. The sections are connected together by fire tubes and water tubes in the following manner. The inside shell of both the front and rear sections is provided with large openings into which 2½ or 3 in. steel tubes are expanded, forming a rigid connection between the two sections.

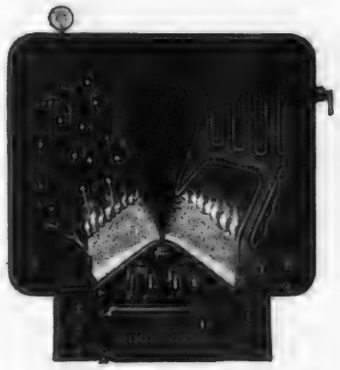


**Fig. 2. Spencer Double Grate Cast Iron Boiler**

In the outside shells opposite the large holes of the inner shell are placed smaller holes of about 1½ in. diameter, into which fire tubes are expanded so as to form a second rigid connection between the two cast-iron sections. The water fills the header sections and the inside of the water tubes. Owing to the fire tubes occupying most of the space inside of the water tubes, the result is a thin film of water in the concentric space between the two tubes with fire on the outside and hot gases passing through the inside. At the front end of the boiler, smoke doors are hung to allow the gases coming forward in the lower tubes to rise up and return to the rear in the upper tubes.

In the rear, a cast-iron smoke box is placed to collect the gases from each side and to pass them into the smoke outlet. The tubes are arranged in such a manner as to form the sides of the magazine by the use of small stops between the tubes so used.

**Fig. 3. Spencer Single Grate Cast Iron Boiler**

INCLINED GRATES TO ASSIST SELF-FEEDING

The grates are set on an incline so that, as the coal burns and turns to ash, the ash is either crushed by the weight of the coal on the incline above, or falls through the grate of its own volition. Fresh coal then slides down to replace the ash, this being a continuous process until a gradual accumulation of clinker makes necessary the cleaning of the fire by shaking the grate.

CAST IRON HEATER

The Spencer heater is also constructed in cast iron, the steel tubes and cast-iron headers being replaced with cast-iron water legs, water jacket and flues and baffles, similar to the construction used in the ordinary cast-iron boiler, but suitably rearranged so that the inclined grate and magazine idea can be retained.

**Fig. 4. Spencer Junior Heater for Cottages and Bungalows**

In Fig. 1 is illustrated the steel tubular heater, which is made with magazine capacities from 1000 to 2000 lbs. of coal, and of varying designs. Fig. 2 is the double grate heater of cast-iron type, suitable for larger dwellings, moderate sized business and industrial buildings, and small apartment houses and churches. The single grate heater is shown in Fig. 3, this being supplied for small buildings, ordinary residences running six to twelve rooms, etc.

The Spencer Junior heater is shown in Fig. 4 this heater being manufactured especially for small houses, small stores, garages and other small buildings.

All these heaters are operated on the same general principles. The fire is started on the grate or grates and a light sprinkling of coal is put over it, after which the magazine is filled up to capacity and the boiler practically operates itself until it is necessary to remove clinkers, clean the ash pit or recharge with coal. This period will vary from 8 to 24 hrs., according to the weather.

# Present Practice in Vapor Heating

Previous articles in this series are:

1. *Webster Type R Modulation System, August*, 1926.
2. *Dunham Home Heating System, August*, 1926.
3. *The Illinois System, September*, 1926.
4. *Hoffman Controlled Heat, September*, 1926.
5. *The Mouat System, October*, 1926.
6. *The Trane System, November*, 1926.
7. *The Sarco System, December*, 1926.
8. *The O-E Perfect 3-in-1 System, January*, 1927.

*In order to make this series of articles fully comprehensive, the systems described and illustrated include such installations as are commonly termed by the manufacturers, or known in the industry, as vapor heating systems.*

## 9. The Gorton System

GORTON vapor heating, known to the trade as the Gorton Single-Pipe Vapor System, is a one-pipe steam system, and in this respect differs from the usual vapor practice.

The arrangement of the piping for a typical layout is shown in Fig. 1, which gives an isometric diagram of a typical installation showing a wet return. It will be noted that only a single pipe is used throughout the whole system, with the exception of the two return connections from the ends of the basement steam mains, shown on the plan.

Various specialties used consist of a packing-lock radiator supply valve, a vapor air-relief valve, a vapor air eliminator and a special boiler regulator.

### RADIATOR INLET VALVE

A sectional illustration of the Gorton radiator inlet is shown in Fig. 2 and a view of the same valve disassembled is given in Fig. 3. Distinguishing characteristics of this inlet valve consist of a full-size, unobstructed passageway in a horizontal direction through the valve, and the full opening or closing of the valve with a quarter turn of the handle.

Referring to Fig. 3, it is observed that the valve's operation is obtained by the turning of the interior plug so as to bring the hole in the plug either parallel or perpendicular to the steam and water flow. This plug is not made of metal, but instead is composed of a mineral composition which, the manufacturers state, does not corrode, soften up or stick.

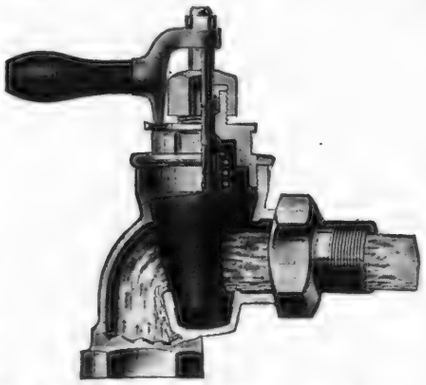


**Fig. 2. Gorton Radiator Inlet Valve—Assembled**

Tests made on this valve by the producers have been made up to what would equal ninety years of service, assuming 200 heating days per annum and that the radiator is opened and closed 15 times per day for each day of the time assumed. This would be 15 times per day times 200 days per year times 90 years, making a total of 270,000 openings and closings of the valve, after which examination of both the plug and interior of the valve showed no signs of wear.

The free and unobstructed passageway in a horizontal direction through this valve is required in order to permit the steam to enter and the water to leave the radiator without interference or conflict. This detail of the system is a most important factor, being necessary to permit the use of the vapor air-relief valve (shown in Fig. 4) on the radiators. The valve is of the quick-vent type and has an air outlet eight times larger than the ordinary automatic air valve.

**Fig. 3. Gorton Radiator Inlet Valve—Disassembled**

### AIR-RELIEF VALVE

The design of the air-relief valve provides sufficient open space inside the valve to prevent water-logging, and also permits a large movement of the valve off of the seat to insure adequate venting, as well as the escape of vapor. Positive movement is obtained in the valve by the compound thermostatic used.

**Fig. 4. Gorton Air-Relief Valve for One-pipe System**

### AIR ELIMINATOR OR STEAM MAIN

On the end of the return main, the vapor air eliminator is installed, this being a valve built the same as the air-relief valve just described, except that it has a vertical connection of ⅜-in. size and the air outlet is approximately four times as large.

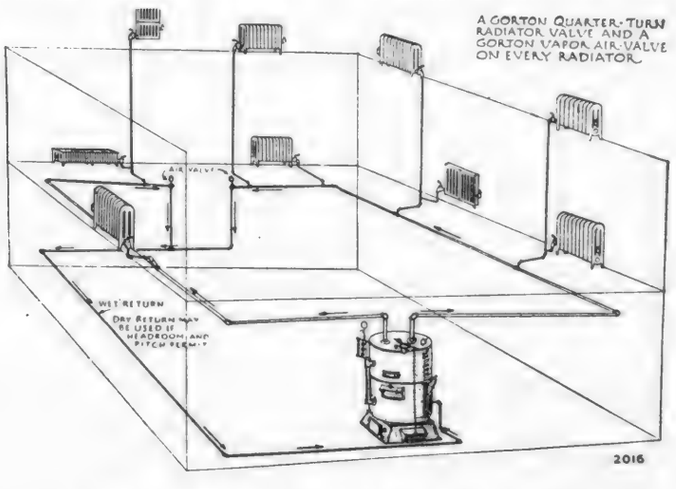

A GORTON QUARTER-TURN RADIATOR VALVE AND A GORTON VAPOR AIR-VALVE ON EVERY RADIATOR
AIR VALVE
WET RETURN
DRY RETURN MAY BE USED IF HEADROOM AND PITCH PERMIT
2016

DIAGRAM SHOWING STEAM MAIN BRANCHING BOTH WAYS FROM BOILER WITH EITHER WET OR DRY RETURN BACK TO BOILER

**Fig. 1. Isometric View of Typical Gorton One-Pipe System**

In the operation of the system, the air eliminator, owing to its larger size, presents less resistance to the flow of air than the air-relief valves on the radiators, and this results in the steam main rapidly filling with steam whenever the system is started up, before steam is delivered to the radiators. The main then acts as a reservoir from which the radiators are fed.

BOILER REGULATION

To regulate the boiler pressure, a Gorton vapor draft regulator is used which is illustrated in Fig. 5, this regulator being of the sensitive type and responding to pressures varying from 2 oz. to 5 lbs. gauge. The large area of

**Fig. 5. Gorton Regulator for Boiler**

the diaphragm transmits the movement to the crossbar by concentrating the entire pressure under the diaphragm and transmitting it onto a small sliding pin which pushes against the crossbar.

Where large boilers of 3000 sq. ft. rating or over are used, it is recommended that two such regulators be installed, one for the purpose of operating the draft door at the base, and the other to operate the flue check draft on the smoke outlet.

When two regulators are so connected up, it is advisable to set the one connected to the flue draft check at one ounce higher pressure than the regulator connected to the base draft. This results in the base draft operating first and the flue draft coming in later, if the base draft does not exert sufficient control alone.

THERMOSTATIC CONTROL AND PRESSURE GAUGE

If a thermostat is used, it should be connected to the back end of the draft regulator lever only, so that it will lift the lever to check the fire and release the lever, leaving it free to work according to the regulator adjustment when more heat is required.

The Gorton vapor pressure gauge is substituted in place of the ordinary boiler steam gauge, this vapor pressure gauge registering graduations in pressure from 2 oz. to 10 lbs. by means of a sensitive spring, which, with a protected and retarded travel, will also register higher pressures from 10 to 30 lbs.

This vapor system is particularly applicable to old one-pipe gravity steam jobs, all the changes necessary being the installation of the vapor specialties above itemized, and a checking over of the grades on the lines to be sure no water pockets exist. It also is used on almost any size of system, from the small bungalow up to jobs involving hundreds of radiators. This system does not attempt to operate at any negative pressures.

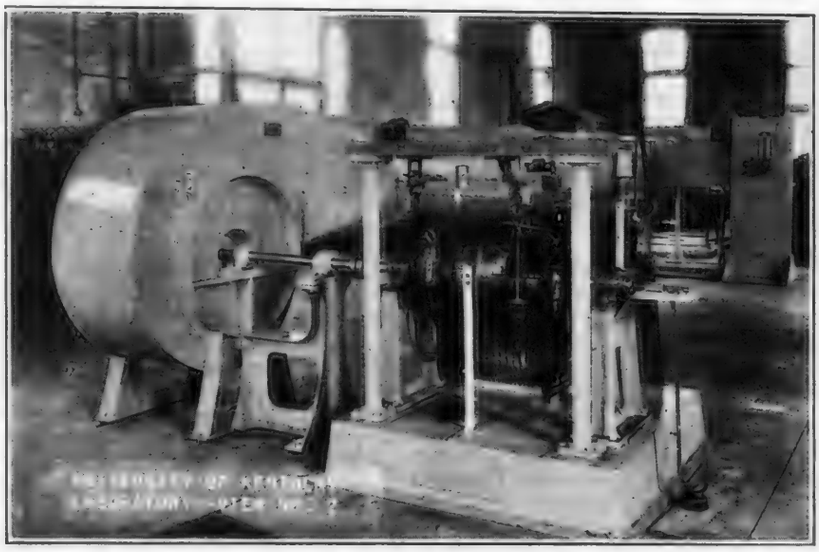


**Fig. 1. Test Set-Up for ME Fan in Laboratory of University of Kentucky, Showing Arrangement of Dynamometer and Test Piping.**

The dynamometer is an alternating-current machine and one of the few in use to-day. To the right, mounted on observer board, is shown the psychrometer, with fan attached, for determining wet and dry-bulb temperatures.

# University of Kentucky Tests on Type ME Fans

A recent test on a Type 31 ME fan, manufactured by the New York Blower Co., Chicago, Ill., was made at the University of Kentucky, and the results are presented in a catalog embodying, in addition to the data, photographic prints of the test set-up. Under the same cover are included details of previous tests conducted upon the same type and size of fan, made a year ago at the Armour Institute of Technology, in Chicago, as reported in THE HEATING AND VENTILATING MAGAZINE for October, 1926.

Both series of tests were conducted in accordance with the standard test code for testing centrifugal fans, as adopted by the American Society of Heating and Ventilating Engineers and the National Association of Fan Manufacturers. It is remarkable how closely the results parallel one another.

Professor Lester A. O'Bannon, professor of thermo-dynamics, had charge of the University of Kentucky tests, which were carried out under the general supervision of Dean F. Paul Anderson.

It should be stated that the figures in the capacity table are taken from the general curve of the No. 31 fan. The published curve, however, is not a characteristic curve, as the performance of the fan is shown for all speeds. In addition, the chart shows the performance at each static pressure from ¼-in. to 2-in. Diagonal lines indicate mechanical efficiency. Thus, the most efficient point of operation for each static pressure is brought out very clearly.

For example, at 1¼-in. static pressure, the most efficient point is at 73.5% efficiency. Reading down on the curve, the R.P.M. is found to be 380. Reading to right and left, the capacity is 7400 C.F.M. and the outlet velocity, 1700 F.P.M. The chart also emphasizes the wide range of capacities at comparatively high efficiency. For instance, from 4000 C.F.M. to 17000 C.F.M., for various static pressures, the efficiency runs higher than 50%.

**Manometers for Recording Pressures**

**Throttling Device at End of Test Pipe**

# Review of 1926 at Underwriters Laboratories

There has just been issued by the Underwriters Laboratories, Chicago, a report of the activities during the past year, from which a number of interesting items stand out.

It is stated that the total volume of work undertaken for clients showed an increase of nearly 20% over that for 1925, and that, during the year, 15,000 copies of reports, ranging from 12 pages to 52 pages were published in printed form.

Eight manufactured products, including oil burners, were put under factory inspection and label service.

An important function of the laboratory has been to co-operate with other organizations with overlapping interests, and the report states that 24 members of the staff have served on 156 committees in 30 national organizations, societies and conferences, 15 in the capacity of chairmen of committees.

### ACTIVITIES IN GASES AND OILS DEPARTMENT

In 1926 the Gases and Oils Department celebrated its twentieth anniversary by establishing a new record for volume and quality of work. As in 1925, the activities of the departmnet centered around oil burners for domestic heating.

This department now occupies more space than was required by the entire laboratory in 1906, and its staff numbers 23, an increase of 2300% over that employed twenty years ago. During the past year an average of three completed reports marked the activities of each working day. The report gives the following data indicative of the growth of the oil-burner industry, as measured by "listings" by the Laboratories:

| Year | Number of Devices Listed | Total Devices Listed |
|---|---|---|
| 1918 | 1 | 1 |
| 1919 | 1 | 2 |
| 1920 | 0 | 2 |
| 1921 | 2 | 4 |
| 1922 | 1 | 5 |
| 1923 | 4 | 9 |
| 1924 | 5 | 14 |
| 1925 | 16 | 30 |
| 1926 | 33 | 63 |

Under the head "Test Equipment for Oil Burners," the report states that:

"During the major portion of the year, 18 furnaces for the testing of oil burners were in constant use. Improvements in arrangement of equipment have been made from time to time in order to facilitate test work, relieve congestion, and add to the accuracy of final results. These alterations have included the building of individual chimneys for the testing of natural-draft oil burners, the installation of five steam boilers, the installation of a new oil storage and handling system, and an addition to the equipment of automatic controls.

"The present arrangements include equipment for the testing of mechanical-draft oil burners with either d.c. or 110-volt, 60-cycle, a.c. motors. Further electrical equipment has been ordered for early delivery to provide facilities for testing burners designed for use in territories where various odd frequencies are encountered. The need for this equipment has been largely developed by the introduction of electric-ignition oil burners, which type of burners makes up a very considerable portion of those now listed.

Considerable progress has been made in the collection of data with regard to the various qualities of oil fuels obtainable on the market in different territories. These data, it is hoped, will soon be of assistance in arriving at some definite conclusion as to the practicability of adopting sufficiently flexible oil-fuel specifications to serve the purpose of both the oil burner manufacturer and the oil producer.

### LABEL SERVICE FOR OIL BURNERS

"A large amount of the time of the engineers engaged in work on oil burners for the closing months of 1926, has been devoted to the long anticipated extension of label service to domestic oil-burners. As announced in July, the change-over from re-examination service to label service was started on October 15, 1926, and at the close of the year, the label service will be in effect in practically all factories which were producing domestic burners under the re-examination service. In a very few cases where for one reason or another it has not been possible to make the change from the re-examination to the label service by December 31, there is every reason to believe that this service will be in effect by the end of January.

### STANDARDS

"Insofar as contact with the industry as a whole is concerned, the past year has given increased evidence of hearty co-operation by manufacturers in the development of sound practices. Continual contact with manufacturers as individuals; with the oil-burner and oil-burner accessory industry as a whole, with the American Oil Burner Association, and with the Chicago Oil Burner Association has assisted in promoting the adoption of well-balanced oil burning ordinances in many communities and in the thorough consideration of 'Underwriters' Laboratories' Tentative Standards for the Construction of Oil Burning Equipment.' It is expected that these oil-burner standards will be ready to be reported for adoption early in 1927."

The report covers 41 pages and is replete with interesting activities of the Laboratories outside of the scope of THE HEATING AND VENTILATING MAGAZINE.

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# T. E. B. Presidents' and Secretaries' Conference

Trade associations as business institutions, the development of competent mechanics and the matter of standardized catalogs were some of the high spots touched upon at the Presidents' and Secretaries' Conference, held in Evansville, Ind., January 11, under the auspices of the National Trade Extension Bureau. Among the speakers were Secretary-Manager William G. Bergner, who presented, at the outset of the conference, an address on its objects; A. R. Herske, manager of the Heating and Piping Contractors Cleveland Association, who talked on "The Trade Association a Business Institution"; H. E. Hulseman, of T.E.B., who spoke on "Our Industries' Standardized Catalog," and John Quinn, who urged more attention to the problem of developing competent mechanics; Edward Winn, who spoke on certified heating; Walter J. Klie, of Cleveland, O., whose subject was "Some Things of Importance"; M. J. Biern, of Buffalo, who talked on "Installment Buying"; and W. L. Lucas, St. Louis, whose subject was "The Quantity Survey."

On the subject of the T.E.B.'s 1927 plans, S. Lewis Hand stated that, among other things, T.E.B. is well along with its plans for the publication of a standard text-book on steam-fitting, similar to the bureau's present text-book on plumbing. In addition, the bureau is planning to publish an instructors' manual to supplement both the steamfitting and plumbing texts.

Under general activities, Mr. Hand referred to the progress being made in the organization of classes for heating and plumbing instruction in local public schools At the present time, he stated, there are classes for heating and plumbing instruction in 121 local public schools. Enrolled in these classes are more than 6000 apprentice plumbers, 1600 journeymen plumbers, 600 apprentice steam fitters and 200 journeymen steam fitters. The need for instructors has presented a pressing problem and is largely responsible for the Annual Conference for Training Plumbing Instructors which is conducted each year by the T.E.B. in Pittsburgh.

Mr. Hand also gave an outline of the program which has been developed by T.E.B. for a series of meetings intended to promote the development of foreman training in the heating and plumbing industries.

### CATALOG STANDARDIZATION

H. E. Hulseman, who spoke on "The Industries' Standardized Catalog," stat-

ed that "due to the T.E.B. activities, the importance of catalogs and cataloguing in the heating and plumbing industries is being given more consideration at present than ever before. He pointed out how, in the past, most consideration in cataloguing was given to proper illustration and description of products, each issuer trying to outdo his competitor in getting out a catalog with higher-type illustrations, better type and paper stock. Very little attention was given to the practical use to which these catalogs were to be put, or the needs and requirements of catalogs for efficiency in buying and selling As a result, catalogs have been issued in all sizes and shapes.

The standardized catalog, stated Mr. Hulseman, was intended primarily for the wholesalers' salesmen's use. Developments soon proved that it could be adopted by the heating contractors and master plumbers equally well. Catalog material furnished in the standardized size could be more systematically filed for reference, estimating, buying and selling.

Another point brought out by Mr. Hulseman was that catalog material in the standardized loose-leaf form makes it possible for the contractor to make up his own catalog for special purposes, such as an estimating catalog for buying, for salesmen, sales room use or as a general catalog for reference. He can condense all of his material into one or more binders, eventually eliminating the 15-ft. shelf of odd-sized and shaped catalogs.

The records of the bureau show that approximately 5500 standardized catalog binders are in the hands of wholesalers and their salesmen at the present time. The movement among the trade is comparatively new; up to the present time 120 heating contractors and master plumbers have provided themselves with standardized catalog binders.

T.E.B. has contracted for these binders in quantities and is giving wholesalers and the trade the benefit of these quantity prices.

One of the final sessions of the conference was devoted to certified heating, the new trend in merchandising, with special reference to the advantages of installment buying, and the quantity survey.

Walter J. Klie, president of the Heating and Piping Contractors Cleveland Association, decried the practice on the part of wholesalers of extending unwarranted credit to contractors.

"There are only three major items of cost on a job," he said, "namely, material, labor and overhead. If a contractor consistently turns in low bids, he has only one 'cushion' to fall back on, and that is his credit. It is up to the jobber to remove this 'cushion.' Let a wholesaler be a wholesaler and not a contractor."

## Massachusetts Institute of Technology Establishes a Course in Building Construction

A course in building construction, to develop professional builders with a broad training in building operations, including business and engineering administration, has been established at Massachusetts Institute of Technology, and will begin in the second term in February.

The course was founded by Louis J. Horowitz, president of the Thompson-Starrett Company of New York, through a grant from the Louis J. and Mary E. Horowitz Foundation.

Professor Ross F. Tucker, a graduate of Technology in the Class of 1892, and until recently a member of the construction staff of the Thompson-Starrett Company in New York and Philadelphia, has been appointed to take charge of the course. He was chosen because of his wide experience in building construction on a large scale.

Training in the new course at Technology will include the study of applied mechanics, strength of materials, the chemistry of explosives, cements and protective coatings, rock formations and soil mechanics, surveying, the design of structural steel, reinforced concrete and masonry.

Special attention will be given to training in banking and investment problems to enable the constructor to meet the broader problems of his work in which he will study engineering administrations, business, corporate and real estate law, contracts, insurance, estimating, cost analysis and accounting.

The course is designed to give a thorough knowledge of the methods, machinery and appliances that enter into assembling and erection of materials of building, and particularly in the coordination of the various crafts and the formulation of time schedules.

The new course will cover four years and leads to the degree of Bachelor of Science.

## Process of Carbonizing Lignites Developed by Bureau of Mines

New processes for utilizing the enormous deposits of lignite in this country have been worked out by the Bureau of Mines and consist of carbonizing the raw lignite and making briquettes of the char, thus producing a high-grade fuel.

Lignite, as it is generally known, is imperfectly or incompletely developed coal. By turning this material into a high-grade fuel a tremendous amount of usable product will result. It is stated that carbonized lignite is excellent for use in producer-gas generators and for burning on specially-designed grates, either under large boilers or when used for domestic heating.

# National Trade Extension Bureau Moves to St. Louis

To carry out more effectively its plans for a national advertising campaign for the heating and plumbing industries, the headquarters of the National Trade Extension Bureau are to be moved from Evansville, Ind., to St. Louis. This change was decided on at a meeting of the T.E.B. directors in Evansville, January 14, when favorable action was taken on the report of a committee composed of Walter J. Kohler, president of the Kohler Company, Kohler Wis.; H. W. Seymour, general sales manager of the Crane Company, Chicago; and Samuel F. Wilson, Newark, N. J., a past president of the National Association of Master Plumbers. This committee had been appointed to map out a national advertising campaign for the heating and plumbing industries, as announced in THE HEATING AND VENTILATING MAGAZINE for December.

Under the heading of "An Enlarged Program of the Plumbing and Heating Industries for Trade Extension," the committee's recommendations provided for:

An increased administration force for T.E.B.

An enlargement of sales helps and publicity, including a comprehensive national advertising campaign.

A more complete research and statistical department.

A women's department to co-operate with the National Federation of Women's Clubs in the campaign for running water in every home.

A test city campaign, to be made in a selected city to prove the value of each service and to determine the best method for carrying it through.

An increased speakers' bureau or field force.

An augmented educational trade association service and accounting service.

Increased emphasis on the apprenticeship service for the heating and plumbing industries.

A new program for financing the bureau's enlarged schedule was adopted.

New officers of the T.E.B., elected at this meeting, are:

President, Albert J. Wilson, San Francisco, who is also president of the National Association of Master Plumbers; vice-president (re-elected), A. M. Maddock, Trenton, N. J.; treasurer (re-elected), A. B. Pierce, N. O. Nelson Mfg. Co., St. Louis.

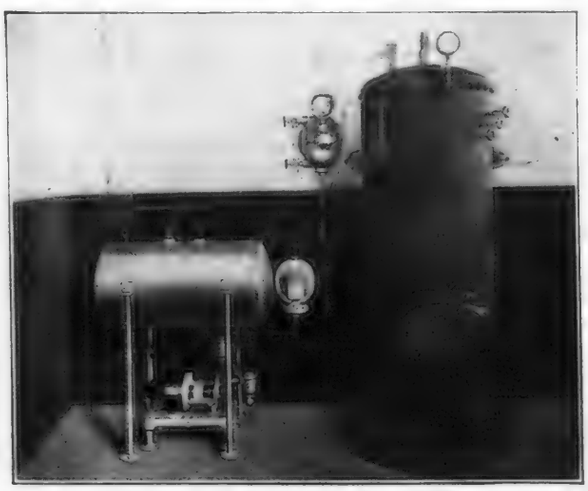
# New Apparatus and Appliances

## The Monarch Return-To-Boiler System

The Monarch Sales and Engineering Company of Chicago, Ill., and St. Louis, Mo., announces a new unit designed to return the condensation and to maintain a uniform water level in the boiler. Details of the equipment are given in the company's bulletin No. V-1126. The unit is built in five sizes for boilers up to 50 H.P. and operating at 100 lbs. working pressure. Comprising the apparatus are a pump, motor, receiver, strainers, automatic water regulator and a combination water-level-switch control. All the returns are received in a tank which is open to the atmosphere. The condensation is held in this tank until the water level in the boiler drops to a predetermined low point. When this occurs, the arm of the low-water float actuates a Mercoid switch. This switch starts the pump which feeds the boiler with water until the water level in the boiler reaches the desired high point whereupon the float arm operates the switch so as to break the circuit and stop the pump. No further operation will occur until the water level in the boiler again reaches the low point. The variation of water level between the high and low points, it is stated, may be maintained as close as 1-in. or may be extended to several inches, if desired, through an adustment on the switch control.

This apparatus is designed to prevent large quantities of water from being forced suddenly into the boiler and the pump is arranged to feed slowly so that the boiler continues to make steam while the pump is working; the quantity of water pumped at one time is not sufficient to cause a drop in the steam pressure.

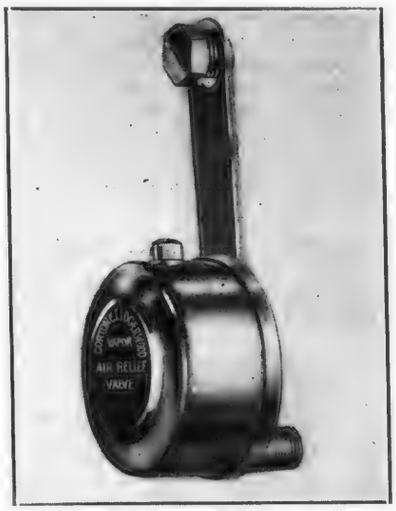
The apparatus is also equipped with a low-water-alarm switch which is arranged to ring an alarm bell, warning the operator if the electric service should fail or if the water supply be shut off, or if the water-line in the boiler should drop to a dangerous point from any other cause.



Monarch Return-to-Boiler System

## Gorton School and Apartment Building Type of Air-Relief Valve

An improved type of radiator air-relief valve, especially designed for use in schools and apartment houses, has recently been developed by Gorton & Lidgerwood, 96 Liberty St., New York City.




New Design of Air Relief Valve for Gorton One-Pipe System

This valve was worked out at the suggestion of the engineer of the Board of Education, City of New York, and is largely used on the Gorton one-pipe system of heating. The idea involved is to make removal of the air valve difficult by unauthorized parties.

To accomplish this a solid piece of strap brass is double riveted to the valve body. It is drilled at the top to allow for the insertion of a hexagon-headed screw with ⅛-in. male pipe-thread. The distance center-to-center of valve tapping and screw tapping is 3½-in. and radiator manufacturers, it is stated, will tap radiators accordingly if requested at time of placing order.

In all respects of operation this valve is the same as the regular Gorton vapor radiator air-relief valve, and, like the regular type, is only furnished with other vapor specialties which make up the Gorton single-pipe system.

## Wing Forced-Draft Unit Now on Market

A new forced-draft blower, especially designed for small furnaces and residence work, is announced by the L. J.

Forced-Draft Unit for Small Warm Air Furnaces

Wing Mfg. Co., 352 West 13th St., New York. This blower is designed to supply sufficient forced draft to burn buckwheat coal in furnaces up to 5 or 6 sq. ft. of grate area, and may be bolted to the floor.

The motor is fully enclosed and dust proof, thus protecting the windings, commutator and bearings from grit and dirt.

When provided with automatic control by means of a thermostat, the blower may be turned off and on so as to maintain a constant steam pressure. Control of intensity of draft is also provided by an adjustable sliding damper.

## Trane Announces Double-Width Heating Cabinet

To meet a demand for a low window radiator of unusual length and heating capacity, and one suitable also for other restricted wall spaces, the Trane Co., La Crosse, Wis., announces a double-width heating cabinet. The cabinet follows the style of the company's present line of heat cabinets, with its heating element in the form of a U-tube with closely-spaced copper plates. In the double-width type, two heating elements are used, placed side by side.

## The Silentvent

Designed to exhaust air from such rooms as chemical laboratories, kitchens, toilets and smoking rooms, the Silentvent has been placed upon the market by The Herman Nelson Corporation, Moline, Ill. It is a device quiet in operation, requiring oiling but twice a year, adaptable to almost any requirement of installation and has a non-corrosive fan capable of moving

**Construction Features of Silentvent**

**(Left) Unit With Intake at Side and Discharge at Top**

**(Right) Unit with Intake on One Side and Discharge on Another**

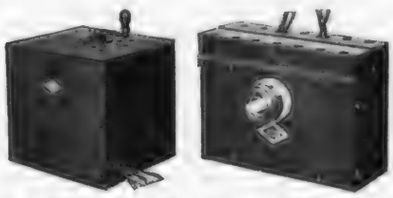
from 300 cu. ft. to 1500 cu. ft. of air per minute.

The fan-motor unit is the same as that used in the Univent, and is enclosed in a rectangular steel casing, finished in green enamel. The unit is removable from the casing for cleaning. The fan is direct-connected to the motor shaft, and is partially telescoped to save space. This brings the fan weight directly over the motor bearings, removing stresses and minimizing vibration. Comparatively few blades to the fan make for low power-cost and free air flow. An allowance of 150 watts provides for the necessary electrical energy.

## The Ilg Squirrel Cage Induction Motor

An alternating current motor has been developed by the research department of the Ilg Electric Ventilating Co., Chicago, which is of the squirrel-cage induction type and has the advantage of being able to run on three-phase current or, by the use of a proper compensator, on a single-phase current.

These motors have been tried out in commercial use for the past three years and the manufacturers state have proved satisfactory in actual service. The motors consist of a solid rotor and a wound stator and have ball-bearing, grease-lubricated bearings. It is said that the rotor is absolutely indestructible, even when entirely blocked, due to the fact that the rotor bars are welded to the



**New Ilg Squirrel-Cage Induction Motor**

short-circuiting rings by the oxyweld process.

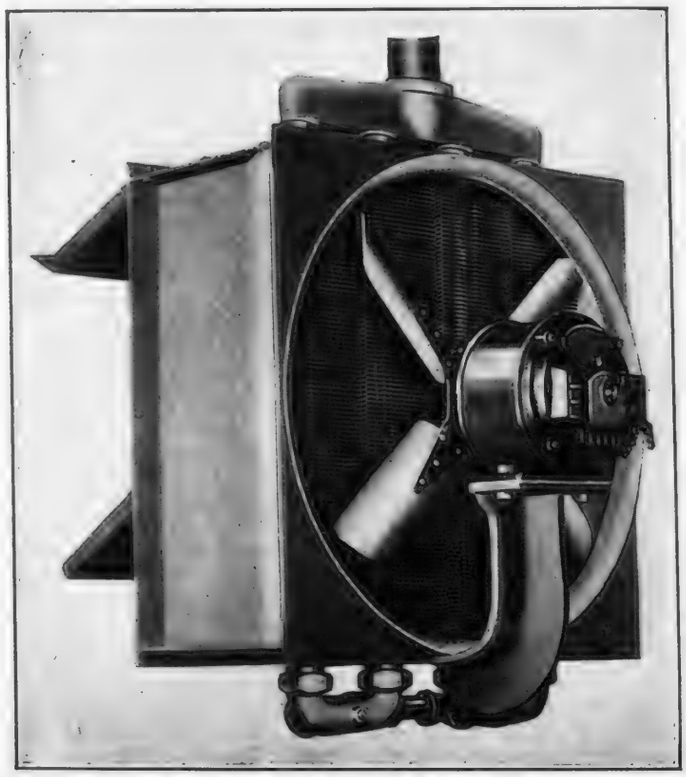
When these motors are used on single-phase current, it is only necessary to connect the three motor-leads to one side of the compensator and then connect the two wires leading from the compensator to the single-phase wiring. The motor then can be thrown in and operated on the single-phase current.

## Automatic Device Controls Duplex Pump Installations

A new device, styled the Automatic Alternator, has been placed on the market by the Chicago Pump Co., Chicago. Its primary purpose is automatically to transfer from one to the other, the load on a duplex Chicago vertical pump installation. The alternator also automatically starts the idle unit of a duplex installation in case of failure of the operating pump to function properly, or if it is not able to handle all the water. This provides for cases of flooding, both pumps working until the abnormal conditions are overcome, when the pumps automatically return to alternate operation.

## New Herman Nelson Unit Heater

A new unit heater known as the No. 20 has been brought out by The Herman Nelson Corporation, Olean, Ill., in response to a demand for a high-grade, compact unit-heater that will operate under working pressures of 100 to 125 lbs. This unit, complete with motor and deflector, weighs approximately 150 lbs. and occupies 4 cu. ft. of overhead



**Herman Nelson Unit Heater**

space. This light weight makes it possible to hang it from the pipe line, thus materially reducing installation costs.

At 1150 r.p.m. each unit will deliver in excess of 2,000 cu. ft. per minute and at 850 r.p.m. over 1,200 cu. ft. per minute. The unit will operate on any steam pressure from atmosphere to 125 lbs. With the motor at full speed, the inlet air 50° and steam pressure at 5 lbs., it will represent the equivalent of 560 sq. ft. of ordinary radiation. Under the same conditions but with 100 lbs. working steam pressure, it represents 960 sq. ft. of ordinary radiation.

Each unit may be automatically or manually controlled without reference to any other unit. It may be installed to recirculate and heat the air in a room or may be so installed as to take outside air only, or as a combination of the two.

The radiator itself is of the extended surface type, the core being cast in one piece of special alloy. Aluminum fins are wedged upon this core and held in intimate contact by spring action. By casting the core in a single piece the liability of leakage is naturally eliminated. It is stated that these radiators have been repeatedly filled with water, frozen and thawed without damages either structurally or fundamentally.

## Applications of Automatic Control to Unit Heaters

Automatic control, as applied to unit heaters equipped with radiators of the honeycomb or copper-fin tube type, has been developed to a considerable extent by the Minneapolis Heat Regulator Co., Minneapolis, Minn. In connection with such control, there are several special features to be considered.

In the first place, there are three elements to be controlled, namely, the room temperature, the steam flow, and the fan. Under manual control, steam is usually turned on all the time, on the theory that there is no necessity for turning it off, because when the fan is not blowing, there is very little condensation. In practice, however, it has proven economical and entirely satisfactory to close off the steam when the fan is shut down, except during the extremely cold weather, when the heaters are in operation for prolonged periods.

Another reason for not shutting off the steam has been that if cold air is drawn from outside directly to the heater, and the fan is started without the steam being present, a freeze-up will result, as well as the unsatisfactory feature of blowing cold air. Automatic control puts into effect the economy which can be obtained only through shutting off the steam when it is not needed.

Since the thermostats are of a low-voltage type, wiring to the thermostat is easy and inexpensive to run, with the result that the room thermostat can be placed at the point where it will actually give proper control of room temperature, instead of being located at the point where it is most convenient to run the 110-volt wires, as is almost invariably the case if a 110-volt thermostatic control is used.

There are three types of Minneapolis automatic controls:

First, a Series 10 thermostat, either with or without clock control, and Series 10 relay, designed to start and stop the fan according to temperature requirements. With this system, the control is much the same as by hand, in that the steam remains on all the time and the fan is started and stopped when the room temperature varies two degrees from the point at which the thermostat indicator is set.

Second, as it is desirable during the greater part of the heating season, to be able to shut off the heater entirely, the following method has been worked out and has received many favorable comments from heating engineers. On this installation three units are used, the Series 20 room thermostat, with or without clock control, a limit control and an A. C. motor. The limit control is installed where it will indicate the presence or lack of steam in the heater. When the room thermostat calls for heat, the motor opens the steam valve but the limit control does not allow the fan to start until steam has entered the heating coil. In closing off, both the valve and the fan are shut off at the same time.

Among the advantages claimed for this control is that it is economical and, where outside air is used, it prevents the fan from operating when there is no steam in the radiator. Many times, of course, in factories, particularly during the Spring and Fall months, all of the heaters are not receiving steam and automatic control prevents the heater from blowing cold or cool air. When used with an outside air duct, an auxiliary damper can also be operated on the outside air duct if required. This installation is arranged to prevent cold air from being blown through the unit heater and, in consequence, to prevent freeze-ups, even though outside air is used.

Third, this method of control is very similar to the second method, except that the Series 10 thermostat is used, with a Series 10 relay, instead of the motor. With this installation, as with the second, the fan cannot be started unless there is steam in the coils of the unit heater. Likewise, if the fan is blowing and for any reason the steam goes down and there is no steam in the heater, the control provides for the immediate shutting-off of the fan.

Heat as supplied with unit heaters can be so easily and quickly distributed that automatic control is essential, both from the standpoint of economy and from that of maintaining the most desirable, healthful temperature, particularly in rooms where a number of people are working.

## Chrome Iron Products for Smoke-Pipe Connections

One of the first things to give out in the life of any heating system is the smoke connection between the boiler and the chimney. This usually occurs every two or three years to the owner's dissatisfaction and the contractor's annoyance.

Exposed to intense heat in winter, to corrosion in the damp cellar during the warm summer months, and to a certain amount of sulphur action from the gases of combustion, the smoke pipe of thin galvanized or black iron soon succumbs.

**Smoke Breeching Constructed of Ascoloy**

In developing new uses for special steels, Joseph T. Ryerson & Son, Inc., Chicago, have successfully applied Ascoloy steel sheets to smoke-pipe work.

Pipes made from these special sheets, it is stated, will last indefinitely. No trouble is experienced by the sheet-metal men in working up this new metal, as any shops using ordinary galvanized sheets can handle this metal with their standard equipment.

Ascoloy is a chrome iron, and has the same general characteristics, so far as rust and corrosion resistance is concerned, as stainless steel. It also has the ability to withstand a temperature of about 1500° F., without having any scale form on the surface.

The sheets are carried in 24 gauge, 24 in. wide and 120 in. long, with a white pickled finish, and can readily be formed into elbows, 45-degree bends, and straight lengths of pipe, inasmuch as the material is soft enough to be double seamed without difficulty.

The average cost of this material is about 3½ to 4 times that of galvanized sheets, but the long life which can be expected from it is estimated to more than offset this additional cost.

# New Trade Publications

SIMPLICITY WITH EFFECTIVENESS is the slogan of a folder on Duro wafer cells for dry air filters, issued by the Duro Air Filter Co., Chicago. This folder shows the unit and framework for supporting same in the built-up dry air filter. The cell itself is stated to be readily cleaned and easily handled as it weighs only 14 lbs.

SAVES 50% TO 70% OF HOT WATER COSTS is the title of a folder put out by Bell & Gossett Co., 3000 Wallace St., Chicago, Ill., and covering Unitem submerged water heaters. This device is described as consisting of copper circulating tubes which are submerged below the water-line of the boiler, subjecting the entire surface of the tube to the temperature of the boiler water. Circulation pipes carry the water heated inside the tubes to a storage tank for domestic use.

MODERN BAKING—INCREASING PRODUCTION THROUGH CLIMATE is the title of a circular received from W. L. Fleisher & Co., Inc., New York, outlining the advantages accruing to baking plants using Sturtevant-Fleisher air conditioning systems. The inside cover shows, photographically, sections of two loaves of bread, one baked in a plant with controlled atmosphere and the other the product of a bakery with no control over its temperature and humidity. The one loaf is uniform in texture and the other shows plainly that it is not good bread. The circular is an interesting story of the effect of controlled humidity and temperature in the preparation and baking of cakes, cookies, crackers, pies and other good things that are now furnished by the larger bakeries with the same degree of uniformity as is found in products manufactured of metal or other such materials. The last page contains a questionnaire which can be used as a basis for determining the cost of an installation for any bakery.

TWENTY YEARS OF PROGRESS is outlined in an interesting booklet received from Ilg Electric Ventilating Co., Chicago. This book commemorates the 20th anniversary of this company. From a small beginning in 1905 when R. A. Ilg began the manufacture of self-cooled motor propeller fans on two floors of the building in West Kinzie Street, Chicago, the company has developed to the point where it occupies a model manufacturing plant.

In an honor roll of employees, ten are listed as having served from 15 to 20 years in the company and a longer list gives the names of those who have been with the company from 5 to 10 years and from 10 to 15 years.

In a historical sketch by S. W. Weis, president of the company, it is stated that when the company was started, there was very little cash in the till, only a handful of employees, and three stockholders. Now the company's assets

**Original Home of Ilg Electric Ventilating Company on West Kinzie Street, Chicago**

are more than a million and a half dollars; there are no outstanding debts and there are 145 stockholders, most of them employees. Several pages are devoted to individual pictures of the employees whose names appear on the honor roll.

**Factory Building Representing Twenty Years of Progress of Ilg Electric Ventilating Company**

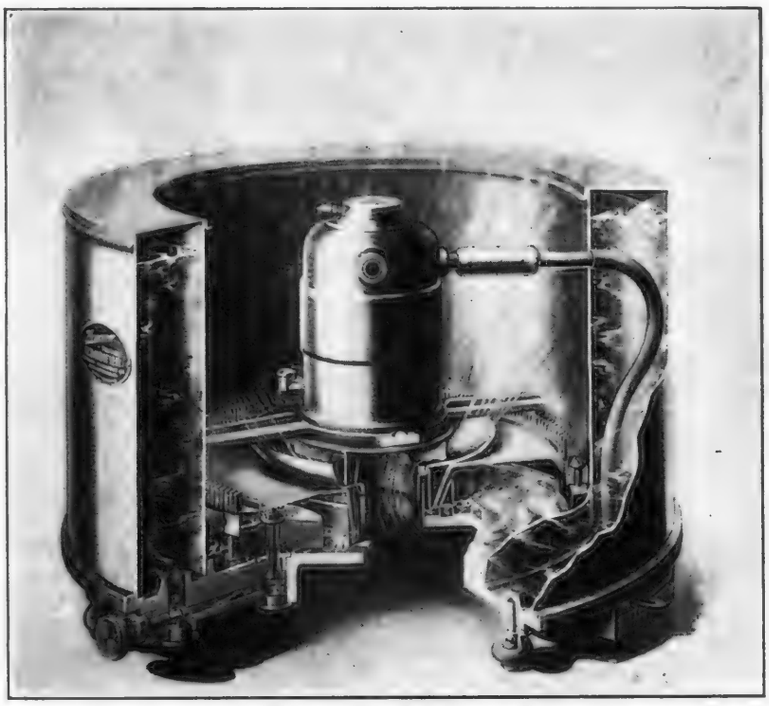
"EVERY KELLY VALVE MAKES WARM FRIENDS" is the slogan on the cover of a folder being mailed by Kelly Brass Works, Chicago, Ill. This folder enumerates the merits of the Kelly sylphon non-adjustable stem air and vacuum valves, which are constructed entirely of brass. The valve contains a float, with a needle-valve at its top and a phosphor-bronze diaphragm for a bottom. Before the float is sealed a definite amount of volatile liquid is enclosed within it. When the float is heated the liquid expands, buckling the diaphragm and causing the needle valve at the top to close and prevent the escape of steam.

**Kelly Air Valve, Showing Vacuum Feature at Top of Valve**

For the vacuum valve a top cap is added, containing a small bronze ball, loosely seated on the outlet from the valve body. When the steam is turned into the radiator, a slight pressure raises the ball, allowing the air to escape. When the steam enters the valve it raises the needle, and closes the escape port. If the steam pressure goes down, a vacuum is immediately created, and the ball prevents cold air from entering the radiator. The maintenance of the vacuum while the radiator is cold aids in quickly filling it when the steam is again turned on.

KING COAL AUTOMATIC MECHANICAL STOKER is the title of Catalog No. 100 issued by Joseph Harrington Co., Harvey, Ill. This catalog covers the application of the stoker, especially to boilers of small size, running from 40 to 250 B. H. P. rating, used either for supplying heat or power. Catalog No. 100 is accompanied by a special survey, made by A. C. Nielsen Co., Chicago, showing the application of the King Coal stoker to a small laundry plant, which shows a 56% annual return on the investment due to savings made in fuel and firing costs.

BRAEMER HUMIDIFIER, which has now been placed on a quantity production basis by the manufacturer, the Universal Humidifying Co., 2013 Sansom St., Philadelphia, Pa., is presented, for the first time in detail, in a catalog just issued by this company. The general features of the design of the Braemer humidifier were the subject of an article in THE HEATING AND VENTILATING MAGAZINE for March, 1926, when a list was also given of the important interests which are behind the new project. The Braemer humidifier was designed by William G. Braemer, who is also the general manager of the company. As described in the catalog, the humidifier is a small type suitable for the house, the apartment, the office, small hospitals and



**Construction Features of Braemer Humidifier**

shops, as well as small schools. It consists of an outer and inner casing of cylindrical shape (the annular space between serving as a water reservoir), the water-feed valve, the float valve regulating the water level in the inner chamber, the driving motor, the revolving atomizing disc, the stationary impingement blades and the fan.

To operate the humidifier the reservoir is filled with water which may be replaced from time to time when necessary. The humidifying capacity can be adjusted by regulating the speed of the motor by means of the lever underneath the unit. This lever also serves as the starting and stopping switch.

Water flows from the float valve to the inner chamber where this valve maintains a constant level. The water then flows from the chamber, through the single-sized port, against the whirling atomizing disc. The disc throws the water outwardly in a thin sheet against the impingement blades when it is broken up into minute particles.

These myriads of fine drops are caught in the upward draft of the fan, which draws air from beneath, and are whirled out into the room air, being vaporized and absorbed almost instantly.

Water which is not broken up into sufficiently small droplets, to be borne upward in the air current, falls back into the inner basin.

By entirely enclosing the motor, troubles from dampness and moisture are both overcome. The manufacturer states that this device operates so quietly as to permit its installation in an office, hall of a house, or even in a hospital room.

In addition to the Braemer humidifier the company manufactures the Thico radiator humidifier which is about to go on the quantity production basis.

DEFIANCE PACKLESS VALVE is described in a little folder issued by Defiance Packless Valve and Mfg. Co., Quincy, Ill. This valve incorporates the packless principle, with metal-to-metal contacts, and is made for various purposes and for both high and low pressures. The steam-radiator valves are made with black bakelite hand-wheels, non-heating. A hot-water valve is listed with the same principles of construction.

GIVE A THOUGHT TO THE CHIMNEY is the suggestive title of a little folder being circulated by the Central Radiator Co., Lansdale, Pa., suggesting the importance of a tight chimney of proper construction for any kind of heating plant. The folder outlines the fundamentals of chimney construction and invites attention to the more comprehensive publication on the same subject, "A Guide to Good Chimney Construction," issued by the same organization.

NOKOL NEWS for December features the sales contest now on between members of the sales organization of The American Nokol Company and its agencies. The points awarded are based on the sizes of burners sold, 10 for the smallest size, 11 for the next three sizes and 12 for the three largest sizes. The issue contains reports of weekly and special prizes to date, and the standing of the leaders in the race for the grand prize. Interesting information is also found in regard to the replies to the questionnaire recently sent out to Nokol users, of which nearly 6000 were received.

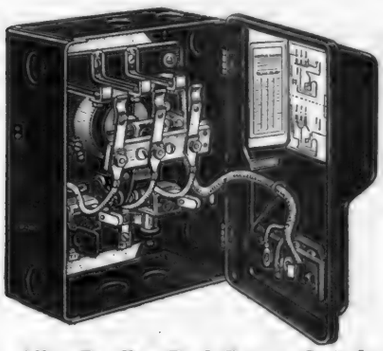
ADD ANOTHER ROOM TO YOUR HOME appears on the cover of a little folder issued by the May Oil Burner Corporation, Baltimore, Md. There is a picture of a typical suburban home on the cover, and, on opening the folder the same home appears in section, the basement being on a turned-up flap at the bottom. The basement contains a coal-fired boiler, the coal-handling tools are standing against the wall, and there are several ash cans, some kindling and a coal bin in the background. This flap bears the caption: "As easy as turning this flap —you can add another room to your home." Upon turning down the flap the same boiler is seen, equipped with a May oil burner, and the space formerly occupied by the coal bin is now a billiard room. The folder carries a real message with few words.

NEW BROWN ELECTRIC FLOW METER is discussed in a folder being put out by the Brown Instrument Co., Philadelphia, Pa. The folder quotes some remarks made by F. R. Low, editor of *Power*, in the issue of February 16, 1926, in regard to boiler plant efficiency, and then states that the meter opens up big possibilities in boiler economy improvement and better cost keeping. Thirteen models of Brown flow meters are illustrated.

REDUCING VALVES AND REGULATORS is the subject of a booklet being put out by Schutte and Koerting Co., Philadelphia, Pa. This bulletin, designated as No. 8-R, is devoted to the subject of reducing valves and reducing valves with relay control. The "Quitetite" reducing valve, the balanced-lever reducing valve, Venturi-type butterfly reducing valve and expansion nozzle reducing valve are featured. Size 8 x 11 in. Pp. 16.

**Quitetite Reducing Valve**

ALLEN-BRADLEY PUSH BUTTON SWITCHES are described in a bulletin being distributed by Allen-Bradley Co., Milwaukee, Wis. These mark an important advance in switching equipment for fractional H.P. motors, and on up to 1½ H.P. These switches, known as Form B, are 6 in. x 8 in. x 4½ in. in size, and incorporate push button control, thermal overload relays and no-voltage protection. They may be used



**Allen-Bradley Push-Button Switch**

with single, two or three-phase motors and, due to their small size, are especially adapted to small refrigerating machines, oil burners, motor-driven bench grinders and similar small tools. The contactors are of copper, and quick-acting and it is stated that maintenance is less than with knife switches. The thermal relay is positive and the solder used has an accurate melting point and is used repeatedly, not requiring renewal.

WEATHER VEIN, published by Carrier Engineering Corporation, Newark, N. J., has its holiday issue devoted to the theatre. It includes an interesting autobiography of Adolph Zukor, the story of his rise from immigrant boy to one of the leaders in the motion picture industry; following this is a profusely illustrated description of the Paramount Theatre, New York. Size 4 x 6½. Pp. 48.

HOUSE COMFORT PAYS FOR ITSELF says a catalog on house insulation, published by the Wood Conversion Co., Cloquet, Minn., manufacturers of Balsam-Wool. The subject of house insulating with the use of Balsam-Wool is gone into in detail and the characteristics and method of application of this insulator are discussed. Size 4½ x 6 in. Pp. 35.

POSITIVE FEED-WATER REGULATION is the subject of a folder issued by the Atlas Valve Co., Newark, N. J., describing the Campbell boiler feed-water regulator. This device consists of a diaphragm-operated control valve, installed in the feed-water line, and a regulating element installed in the water column. This delivers to the diaphragm of the control valve a pressure that gradually increases as the water level in the column increases beyond a predetermined level, thereby gradually closing the control valve, which reduces the water input to the boiler. As the water falls below the predetermined level, the pressure delivered by the regulator to the control valve decreases and permits the valve to open and speed up the water input. There are no moving parts in the regulator, fluctuating feed-water pressure does not affect the control valve, and no adjusting is required.

SAVE YOUR WALLS WITH THERM-O-FLECTOR HEAT DEFLECTING RADIATOR SHIELDS is the advice given in a circular issued by the J. D. Gerken Co., Toledo, O. The styles shown include a cabinet type for higher radiators and bench-type for lower radiators, a low open type and a standard open type.

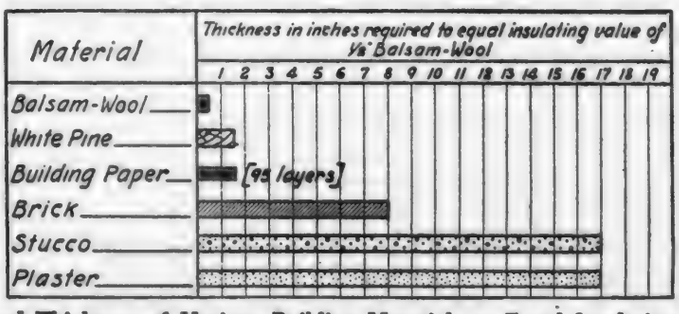
**Cabinet Type of Thermoflector**

Each type is provided with a humidifier comprised of a water pan which rests practically on the radiator and is refilled through a small filter door of the flush-type located on one end of the cover.

CARBON MONOXIDE ASPHYXIATION AND ITS PREVENTION appears on the cover of an excellent publication prepared by B. F. Sturtevant Co., Boston, Mass., designed to bring forcibly to the attention of garage owners the dangers which may arise if garages are not properly ventilated. Rather than an engineering treatise, this bulletin discusses the properties of carbon monoxide gas and the after effects and treatment of monoxide poisoning. It brings out the great danger of this gas because it has no odor or color. As an example of the danger resulting from "warming up" an automobile engine before leaving a private garage or opening its doors, the bulletin states that an engine of the size used in Ford cars will contaminate to the danger point the air in a 10 ft. x 10 ft. x 10 ft. garage in about three minutes. A section gives the various degrees of monoxide concentration that will result in just an appreciable effect, in serious headache, and in death. The effects of intermittent and of continuous exposure, the after effects and the methods of treatment are given in detail. A section of the bulletin is devoted to the subject of private garages and their ventilation, showing typical plans and elevations, with proper fan installation. Another section takes up the more complicated problem of public garages, with diagrams and illustrations to exemplify the best practice in various types of garages. Size 8½ in. x 11 in.

MODERN HOME HEATING appears on the cover of a piece of literature sent out by Wayne Co., Fort Wayne, Ind., with the sub-caption, "A Discussion of the Oil Burner and Its Place in the Modern Home." In addition to being an excellent piece of catalog work, the text matter in this booklet is outstanding in its presentation of the domestic oil-burner problem. It is remarkably free from exaggeration, even in details, and in telling the story of the design and construction of the Wayne burner, the absence of flamboyant phraseology is particularly noticeable. There is a general discussion of the problem as a whole, which paints a very fair picture of the present-day status of the application of oil burners to the heating of homes. There is then a technical description of the burner, which is elaborate enough to satisfy the most exacting engineer and at the same time, simple enough in expression and so well illustrated, that the average home owner would find no difficulty in understanding the operation of this burner. As a whole, this catalog presents one of the fairest views of the domestic oil-burner problem that has been put into type. Size 8½ x 11 in. Pp. 28.

THE TAG RECORDER CATALOG has just been issued by C. J. Tagliabue Mfg. Co., temperature engineers, Brooklyn, N. Y. It is a veritable encyclopedia of heat recording devices, beautifully illustrated with large sections of charts, in color, and with half-size pictures of many of the important instruments. The importance of temperature-recording charts in industry is exemplified in a story "What a Chart Can Tell You" and an interesting chapter outlines the endurance test to which Tag recorders are subjected. The catalog apparently represents a great deal of thought and careful attention in its composition. Size 8½ in. x 11 in. Pp. 104.


Material
Thickness in inches required to equal insulating value of ½" Balsam-Wool
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
Balsam-Wool
White Pine
Building Paper
[95 layers]
Brick
Stucco
Plaster

**Required Thickness of Various Building Materials to Equal Insulating Value of ½-in. of Balsam-Wool**

# Present Accepted Practice in Domestic Oil Burners

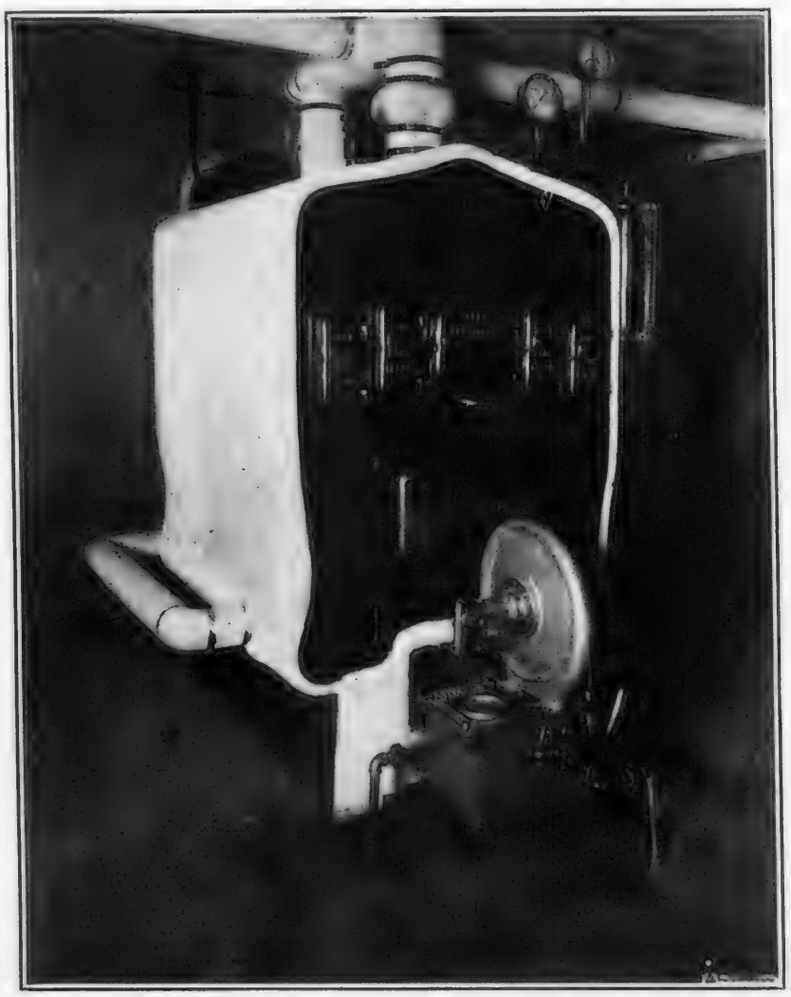
## 26—Petro. "Gun" Type, Turbine Atomizer, Mechanical Draft, Electric-Gas Ignition

Previous articles in this series are:

1. *Kleen Heet, July*, 1925.
2. *Baker, July*, 1925.
3. *Kerrihard, July*, 1925.
4. *Silent Glow, August*, 1925.
5. *Aetna, August*, 1925.
6. *Caloroil, September*, 1925.
7. *Oil-O-Matic, September*, 1925.
8. *Chalmers, October*, 1925.
9. *Hart, October*, 1925.
10. *Sun, October*, 1925.
11. *Rayfield, November*, 1925.
12. *A. B. C., November*, 1925.
13. *Electrol, December*, 1925.
14. *Grant, January*, 1926.
15. *Nu-Way, January*, 1926.
16. *Wayne, February*, 1926.
17. *May, February*, 1926.
18. *Ray Rotary, March*, 1926.
19. *Super Oil Heator, May*, 1926.
20. *Nokol, July*, 1926.
21. *Johnson, August*, 1926.
22. *Arrow, September*, 1926.
23. *Safe Fire, October*, 1926.
24. *Sword, November*, 1926.
25. *Hardinge, January*, 1927.

THE Petro Residence burner is a product of the Petroleum Heat & Power Company, 511 Fifth Avenue, New York City. The organization back of this automatic burner has been manufacturing and installing oil burning equipment since 1903.

This burner is an outstanding example of an industrial burner principle applied to an automatic domestic burner. It combines, in a single compact and symmetrical unit, a turbine atomizer or gun, motor, fan, pump, and motor switch, all of which are mounted on a cast-iron base which sets in front of the boiler or furnace with none of its parts inside of the combustion chamber. The ignition system is an automatic electric-gas, which is called into operation only when the room thermostat calls for heat. The Honeywell safety-control, actuated by flue temperature, is coupled up with the burner.



**Typical Petro Residence Burner Installation**

### TURBINE ATOMIZER SIMILAR TO INDUSTRIAL "GUN"

The turbine atomizer or gun, which breaks the oil up into a fine mist, is of the revolving-cup type. Air from the specially designed fan enters the gun and impinges on a turbine wheel, which is part of the rotating cup, supported on ball bearings.

This is the same fundamental design as the Petro industrial burner and insures a high cup speed which will cause the oil to be finely broken up and permits it to be burned in a relatively small combustion space, minimizing any tendency towards unburnt oil impinging on the brick work or parts of the boiler.

The relative position of the edge of the nozzle and the cup can be adjusted to produce either a long narrow cone of flame suitable for long boilers or a wide fan shape flame for square or round boilers.

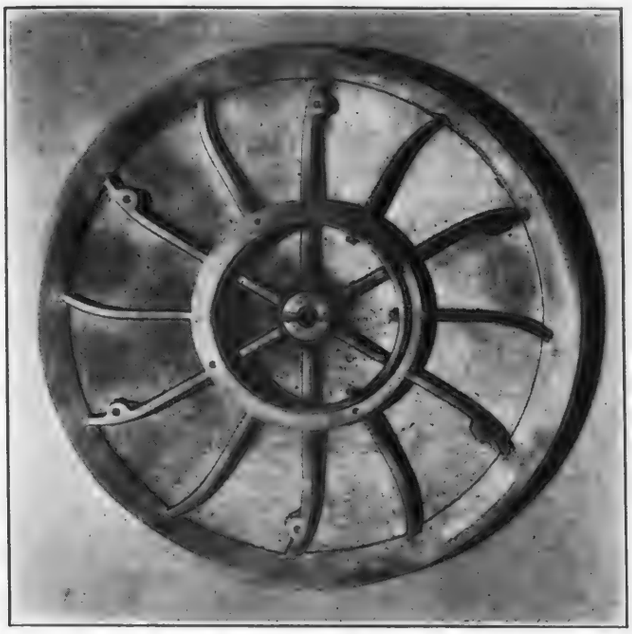
### SMALL MOTOR USED

The engineering skill that has gone into the design of this burner is typified in the 1/6 h.p. Westinghouse motor, carrying the full load of the burner with a motor input of 210 watts for the LD-1 size, with a maximum capacity of 5 gal. per hour, and of 225 watts for the LD-2 size, with a maximum capacity of 12 gal. per hour. The rotor and stator are manufactured by Westinghouse and the other necessary parts by the Petroleum Heat & Power Company. Ball bearings are characteristic of this motor. Slip rings are avoided by the use of a split-phase motor employing a centrifugal cutout switch.

The motor is totally enclosed and mounted rigidly in place in the air intake to the fan. Cool air entering the fan passes around the motor casing keeping it at a normal temperature and the motor being totally enclosed, no dust or dirt can enter its interior. A unique lubrication system requiring Alemite but once a year keeps the motor bearings in perfect condition. The system is so designed as to eliminate any possibility of oil or grease seeping into the motor windings. These motors have been used for years by the Petroleum Heat & Power Company, and are considered particularly adaptable to intermittent, automatic oil burner service.

### UNIQUE FAN IS PRACTICALLY NOISELESS

The fan, direct driven from the motor shaft, is one of the important features of the burner, both on account of its almost noiseless operation, and its high mechanical efficiency. It is fabricated from two parts, one a cast aluminum disc with blades or runners cast on its sides, and a cover plate, also of aluminum, riveted to it. By virtue of the



**Petro Fan Casting Without Cover**

design of the fan, the air, instead of escaping from its periphery in a series of puffs, is delivered in a steady flow, without an audible beat note. The fan assemblies are dynamically balanced in a special machine, and the result is a fan whose operation cannot be detected by ear.

THE OIL PUMP AND THE METHOD OF HANDLING OIL

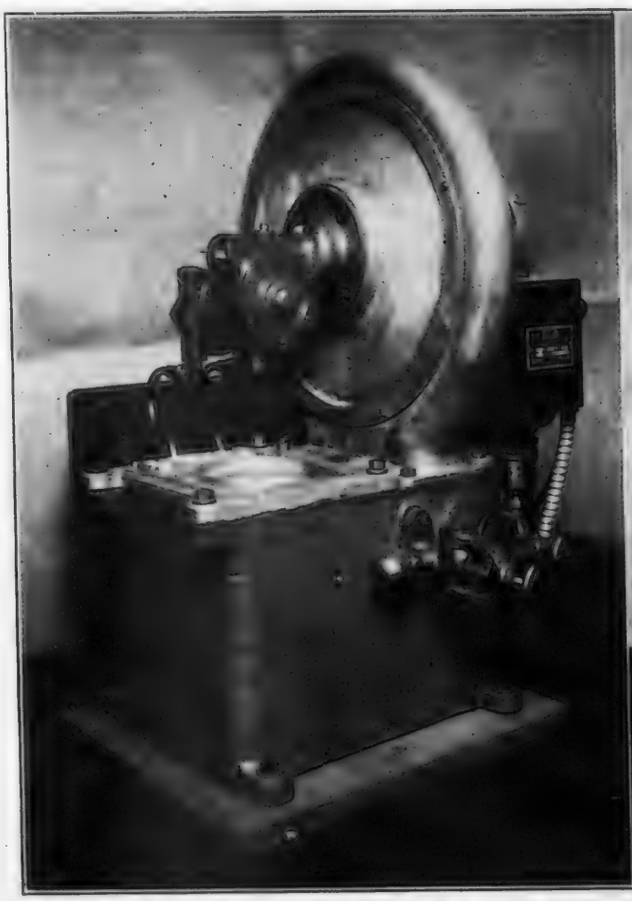
In the gear pump and its worm drive is another example of adapting proven industrial burner practice to a small domestic unit. The pump gears are made of steel and the pump casing of phosphor bronze. The worm driving the pump is coupled to the fan and motor through a simple flexible coupling. The pump is capable of creating a vacuum of 26 in. of mercury and has a capacity up to 30 gal. per hour of oil. The pump receives its priming, each time the burner starts, from the float chamber which is situated directly beneath it.

The Petro burner is unique in the fact that while it employs a pump with a capacity greatly in excess of any load that might be required, it does not require any overflow line returning to the oil storage tank. By means of a specially-designed anti-siphon valve the oil-storage tank can be placed above the burner and only the oil required will be drawn over by the pump. The oil is delivered by the pump to a chamber where a carefully designed three way valve regulates the amount of oil coming over from the oil-storage tank.

If there is any tendency for too much oil to come over from the oil-storage tank the float actuating the three way valve will rise and shut off the supply from the tank and will cause it to be circulated from the float chamber, back through the pump and into the float chamber again. When the level of the oil drops a sufficient amount the float will actuate the valve, opening the port to the oil-storage tank. It is interesting to note that the oil level in this float chamber is always maintained below the oil feed to the atomizing turbine or gun or below any opening in the burner, thereby eliminating any possibility of overflowing oil.

To raise the oil from the level maintained by the float to the higher level of the fuel feed tube of the gun, air pressure from the fan is allowed to enter the float chamber through a port.

At a definite time a 6-oz. pressure is created in the float chamber, which is covered with an air-tight cover, readily removable. The oil is then raised through a port in the base casting and through a yoke which securely holds the gun in place, into the fuel tube in the gun and is finally deposited into the rotating cup and atomized. This yoke which holds the gun in place can be easily unscrewed by hand and the gun removed with little effort. Even if the burner is running no oil will escape when the gun is removed for, in swinging the yoke back, the oil supply is closed off. Obviously when the burner is not running the pump is not drawing over any oil, nor is there any pressure



**The Fan is Mounted on the Base Casting Which Contains the Oil Chamber**

**The Turbine Atomizing Cup With Surrounding Vanes Controlling Secondary Air Supply**

from the fan on the oil in the float chamber and consequently it is always maintained below the level of any opening. This assembly of the pump, float chamber and simple valve mechanism insures safety whether the burner is at rest or in operation.

AN ELECTRIC-GAS IGNITION SYSTEM USED

A brief study of the Petro ignition system is of interest. It is stated by the manufacturers that they will not employ electric ignition exclusively, without the use of gas, because they feel it is bound to increase the necessity for service, especially when using the heavier oil fuels. This system of electric-gas ignition is timed from gears on the Honeywell motor switch. When the room thermostat calls for heat the two minute Honeywell rotating switch begins its operation and the burner-motor starts.

At a definite time a spark is created and the rotation of the Honeywell motor switch opens the gas valve. The gas is ignited and, at a definite time-period after this takes place, the oil is gradually fed to the turbine atomizer or gun and is ignited by the gas pilot. The size of the flame increases gradually until it attains its maximum predetermined size (set in accordance with the boiler or furnace capacity) and at a definite time-interval the spark and gas are shut off. Each time the burner ignites it consumes 1/3 cu. ft. of gas and, based on 2000 such operations during a heating season, it consumes less than 1000 cu. ft. of gas in a normal season.

Detail Showing (left) "Gun" in Place and (right) Yoke Swung Back and "Gun" Partly Withdrawn

SECONDARY AIR CONTROLLED BY DAMPER

The air register used on Petro industrial burners has been adapted to the domestic sizes and a certain amount of air, at a low pressure to minimize noise, is supplied by the fan but the additional air required for proper combustion is admitted through an adjustable register which surrounds the gun.

In addition to the safety features incorporated in the float chamber, which regulates the flow of oil from the oil-storage tank and the anti-siphon valve, the continued performance of the burner is controlled by a Honeywell combustion thermostat.

Because of the simplicity of the burner assembly the installation cost is reduced to a minimum. There is no assembly work to be done at the time of installation. Even a cork pad with a metal covering on which the burner sets is supplied with the equipment, adding to its general appearance and also cushioning the burner. One is particularly impressed by the absence of mechanical and combustion noise when the burner is in operation.

The Petro Residence burner is built in but two sizes, known as DL-1, and DL-2, suitable for any loads from a small hot-water service-boiler to a boiler capable of handling 4500 sq. ft. of net connected steam load. There are only two simple adjustments required irrespective of the varying conditions—one adjustment for oil and the other for secondary air.

The Petroleum Heat and Power Company, having developed the domestic burner as an aftermath of a large experience in the industrial field, is following distribution lines similar to those practiced in the past. The company maintains offices in several important eastern cities, and, through its subsidiary, The Fess System Company, on the West coast. All burners that have been installed are within reach of these points, and the company maintains fuel distribution facilities enabling it to provide proper fuel to its customers.

The Petro Residence burner is listed by the Underwriters to burn oil fuels not heavier than 32° A.P.I.

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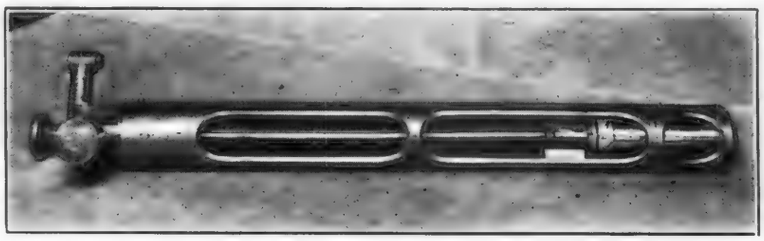
## Careless Installation Gives Black Eye to Oil Burners

It is becoming more and more apparent that, while almost any fairly good oil-burner, if properly installed, is capable of giving reasonably satisfactory service, careless installation of even a high-grade burner is apt to end disastrously, both for the customer and for the organization that permits such an installation.

An example of this has come through correspondence to THE HEATING AND VENTILATING MAGAZINE. The following extract tells the story:



A Cutaway Petro "Gun"

"Four burners of a certain make were operating in two large cast-iron sectional heating boilers in the basement of a six-story office building. The tenants complained about poor heat and the man who installed the burners did a lot of worrying and spent a lot of time wondering why the burners did not heat the building. Surely they were burning oil enough. The burners had not been paid for and the manager of the building ordered him to remove them since they were not satisfactory.

"Two oil burners of a different type were installed and exactly the same kind of fuel was burned. In the second case dampers were installed on each boiler to make it possible to regulate the draft. Everything went fine in the second installation and the first burners were discredited in the entire community. Now, it is my honest opinion that the only thing wrong with the first installation was the draft. A large flue went clear to the top of this six-story building and was causing the heat and a lot of excess air to be drawn through the boiler with such speed that it could not be transferred to the water.

"So many people have jumped into the oil-burner business without any knowledge whatever of combustion, that the entire industry is being injured. Any one who could devise some odd or complicated shape, or figure out some new way to introduce the oil and air thought he had developed the ideal burner and, with his enthusiastic friends, would start in to make millions. I believe the larger and more important burner manufacturers are giving more attention to installation, for they have learned that it is not all in the design.

"I have never yet found an oil burner which was installed and set by eye, or, in other words, by guess, without being able materially to improve the efficiency of the combustion by testing the flue gas as a guide to adjustments of the air-fuel ratio."

# Trade and Miscellaneous Notes

## Coming Events

**February 15-19, 1927.** Chicago Power Show, Chicago, Ill.

**February 15-18, 1927.** Midwest Power Conference, at Coliseum, Chicago, Ill., with sessions held concurrently with the Chicago Power Show.

**February 15-19, 1927.** Forty-first annual meeting of Engineering Institute of Canada. Opening session in Montreal at the Institute headquarters, January 27, with adjournment to reconvene at Quebec, February 15, 16 and 17.

**February 19-26, 1927.** New York Annual Own-Your-Home Exposition, Madison Square Garden, New York.

**February 21-March 5, 1927.** Second Architectural and Allied Arts exposition, under the auspices of the Architectural League of New York, Grand Central Palace, New York. Executive offices, 105 West 40th Street, New York.

**March 14-19, 1927.** Second National Heating and Ventilating Exposition at Twelfth Regiment Armory, Columbus Avenue, 61st to 62nd Streets, New York.

**April 2-9, 1927.** Chicago Seventh Annual Own-Your-Home Exposition, Coliseum, Chicago, Ill.

**April 5-7, 1927.** Annual convention of American Oil Burner Association, in Buffalo, N. Y.

**May 10-13, 1927.** Eighteenth annual convention of National District Heating Association in West Baden, Ind. Headquarters at the West Baden Springs Hotel.

**June 1-4, 1927.** Thirty-eighth annual convention of the Heating and Piping Contractors National Association in West Baden, Ind. Headquarters at the West Baden Springs Hotel.

## Miscellaneous Notes

**December Construction Figures,** compiled by the F. W. Dodge Corporation and embracing the work included in 37 States east of the Rocky Mountains, ran about 10% over November and 2% over December, 1925. New York State and northern New Jersey construction contracts amounted to $226,495,700, this being an increase of 92% over November, 1926, and 7% over December, 1925. In the New England States a decline of 9% for November and 3% from December, 1925, is shown.

For the Middle States section there was an increase of 21% over December, 1925, but a decrease of 30% from November, 1926. In the Pittsburgh district, December exceeded November by 9% and also exceeded November, 1925, by 2%. In the Central West there was an increase of 16% over December, 1925, but a decrease of 18% from November, 1926. In the southeastern States decreases of 26% for December, 1926, and 42% for December, 1925, are reported. In the northwest losses of 35% for November and 34% for December, 1925, are shown. Texas had $232,411,800 worth of contracts awarded in 1926, which was 25% over the total for 1925. This district showed the greatest percentage of increase over 1925 of any section in the country. Contracts let during December showed 30% in excess of November, but were 4% below December, 1925.

For the country in general 1926 construction volume was the highest on record for any year, exceeding 1925 by about 6% in the 37 States included in the report, and a probable increase of about 4% for the whole country.

**Boston, Mass.**—J. W. H. Myrick has been appointed as engineer on the Boston Schoolhouse Commission. This commission supervises all school house construction in the city of Boston and


# Every User a Satisfied One!

## Read These Actual Statements *about* AUTOVENT UNIT HEATERS

**From a Factory Engineer:—**

"This equipment has been in service for about two months and it is operating very satisfactorily.

"While we have not made any technical tests upon its efficiency, we are quite sure that it is fulfilling all we expected it to do."

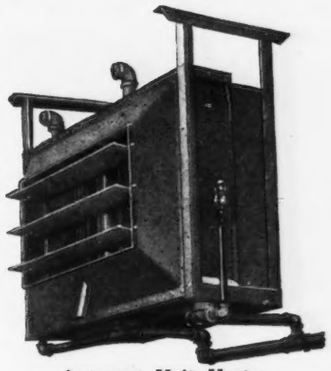
**From Another Factory Owner:—**

"We are so very much pleased and satisfied with it, that there are no words which could express how much we appreciate this heater.

"We will always recommend your heater to any of your future prospects."

**And, from a Heating Contractor:—**

"The No. 203 Heater purchased from you is working very satisfactorily, and if we have a chance, we shall of course, endeavor to use more of your heaters."



Autovent Unit Heater
Ceiling Type

## Co-operation!

Our customers like the whole-hearted help that we give them. Our chief aim is to make every customer a satisfied one. And the word—*Co-operation*—tells how we do it.

You will like it too! Try us on your next job.

***Estimates and prices cheerfully furnished by our Engineering Department.***

**AUTOVENT FAN & BLOWER CO.**
**730-738 W. Monroe St., CHICAGO**
**ENGINEERS IN ALL PRINCIPAL CITIES**

includes an engineering department which designs heating, ventilating, plumbing and electrical work.

**National Association of Plumbing and Heating Salesmen** will hold its second annual convention May 26-28, 1927, at the Robert Treat Hotel, Newark, N. J. A tentative program has already been arranged and committees appointed.

## Manufacturers' Notes

**Midwest Air Filters, Inc.,** Bradford, Pa., advises that E. S. Bishop has been promoted to general sales manager. Mr. Bishop formerly was New York district manager.

**York Heating & Ventilating Corporation,** Philadelphia, Pa., whose two-day sales convention was held in Philadelphia, January 17-18, reports an unusually successful year, with the prospects bright for a corresponding advance in 1927. The new vice-president of the company, H. P. Gant, was among the speakers at the convention. Following the first day's sessions, the company tendered its guests a dinner at the Manufacturers' Club in Philadelphia, at which the guests included President William H. Driscoll, of the American Society of Heating and Ventilating Engineers; J. L. Goodwin, president, and W. C. Beekley, vice-president in charge of sales, of the Whitlock Coil Pipe Co., of Hartford, Conn., this company being the manufacturer of the pipe coils used in the York heaters; W. B. Mackenzie, of W. P. Mackenzie & Co., heating contractors, of Philadelphia; Robinson Murray, of Breeding, Murray & Salzer, Philadelphia, the company's advertising counsel; and A. S. Armagnac, editor of THE HEATING AND VENTILATING MAGAZINE.

Bonus prizes were awarded by President Thornton Lewis, at the dinner, to the company's Chicago office, Indianapolis office and Detroit office for having finished the year with a volume of business which gave them the first, second and third highest percentages of the quotas established for the year. In addition to the cash prizes, in the form of bags of "gilt discs," these branch offices were presented with handsomely-executed certificates of award. The Chicago office was represented by W. D. Graham, the Indianapolis office by G. O. Jackson, and the Detroit office by J. S. Kilmer. A special award in the shape of a gold watch was given to Mr. Graham, while C. E. Scott, research engineer, H. Horn, factory superintendent, and H. Simons, assistant factory superintendent, came in for stock bonuses. In last month's item, announcing Mr. Gant's connection with the company, it was stated that he acted as chairman of the A.S.H.&V.E. Research Committee in 1896. As is well known, Mr. Gant has been the Research Committee chairman during the past year.

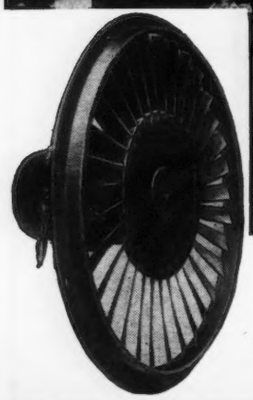
**Trane Company,** La Crosse, Wis., whose appointment of W. E. Bilyeu as sales manager of the company was announced last month, referred, in the original announcement, to Mr. Bilyeu's former connection with Warren Webster & Company for a period of sixteen years. During the past two years he acted as assistant sales manager for Warren Webster & Company. His activities in that position brought him into direct contact with agencies from coast to coast, which experience has been supplemented by a visit to foreign fields, such as England, France, Belgium, Italy and Switzerland. In last month's issue it was inadvertently stated that for the past two years Mr. Bilyeu had been assistant sales manager for the Trane Company.

**Youngstown Sheet & Tube Co.,** Youngstown, O., has appointed Fred Egglestone in charge of its Boston Branch, being transferred from the Atlanta, Ga., office. Arthur Purnell has been made manager of the Pittsburgh branch.

**United States Radiator Corporation,** Detroit, Mich., announces that A. L. McArdle, who was previously connected with the Columbus, O., branch, has been transferred to the Philadelphia branch.

**Silent Glow Oil Burner Co.,** Hartford, Conn., has opened a New York State branch at 1059 South Salina St., Syracuse, N. Y., with A. L. Barager in charge. Mr. Barager was formerly retail sales manager at the Hartford, Conn., factory. The name under which business will be transacted from the Syracuse branch is the Silent Glow Oil Burner Company, of New York, and all


# For Highly Efficient Air Deliveries Through Ducts Use De Bothezat Disc Pressure Fans



*Picture shows a section of duct installation at the Harding Photo Engraving Plant, New York City. The arrow indicates location of fan. View of branch duct can be seen on above picture.*

Installation at Harding Photo Engraving Plant, New York City, gives a striking example of exceptional characteristics of the **De Bothezat Disc Pressure Fans.**

One 30" **De Bothezat Disc Pressure Fan,** equipped with only one horsepower motor, was installed to properly ventilate this plant, which consists of two galleries, studio, etching, drying and dark rooms, ten individual sections in all.

This exceptional result was obtained with one fan and a distribution of ducts throughout the entire plant.

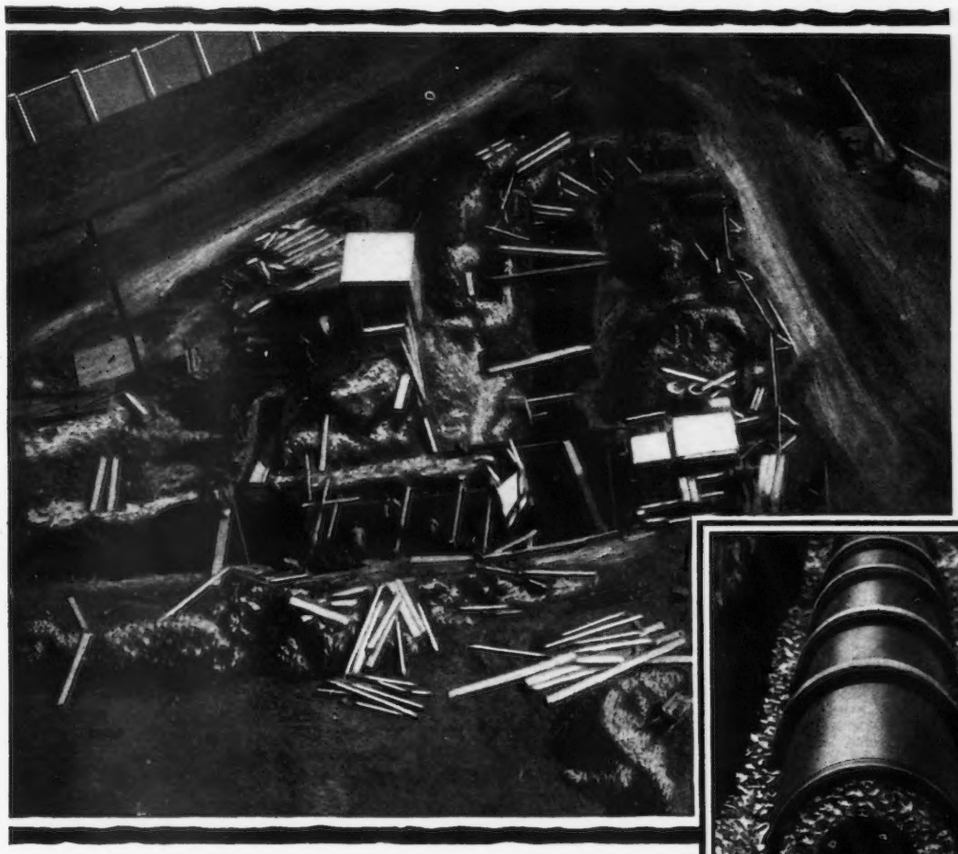
From the above it is evident that **De Bothezat Disc Pressure Fans,** being scientifically designed, will develop the necessary static pressure to overcome resistance created within duct installations.

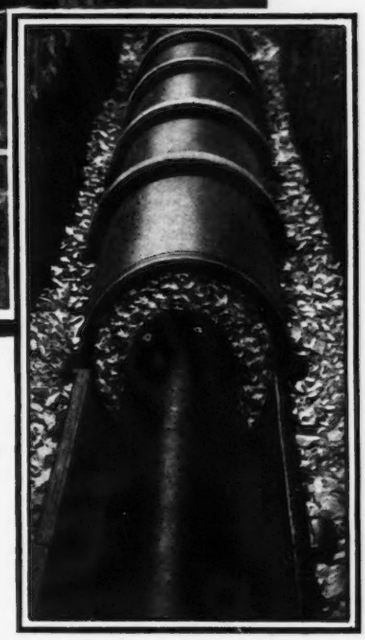
*Attention is brought to the high efficiency, lower installation cost and small operating cost as compared with a blower producing equivalent air delivery.*

**De Bothezat Disc Pressure Fans** for positive results.

**Write for catalogue HV.**

**De Bothezat Impeller Co.**
**Incorporated**
**1922 Park Ave., New York City**





# Trench Warfare

## in the battle for steam line efficiency

AT Johns-Manville you find the skillful generalship and the best fighting equipment to keep B.T.U.'s imprisoned in your underground steam lines.

Engineers of ingenuity and skill, the highest quality materials available, the best design possible, all combine to produce an Underground System of Insulation that we can guarantee to be at least 90% efficient. But in almost every case the heat saved runs higher than the guarantee. This system couples an efficient plant to an efficient distributing system, resulting in maximum economy in heating service.

The Underground System of Insulation is built on a "twenty years after" basis. It's more than a sale of materials—it's the promise of satisfactory service in future years.

Through Asbestos and its allied products
INSULATION
BRAKE LININGS
ROOFINGS
PACKINGS
CEMENTS
FIRE PREVENTION PRODUCTS

JOHNS-MANVILLE CORPORATION, Madison Avenue at 41st Street, New York
*Branches in all large cities.* For Canada: Canadian Johns-Manville Co., Ltd., Toronto

# JOHNS-MANVILLE

## Underground System of Insulation

oil burners for New York State delivery will be shipped from the Syracuse warehouse.

**Milwaukee Valve Co.,** Milwaukee, Wis., has appointed A. F. Auerbach direct factory representative, with offices in Room 2709, Grand Central Terminal, New York City.

**Goudie Oil Burner Co.,** 5820 North Clark St., Chicago, has appointed W. J. Price as sales manager, and A. G. Wade as combustion and air conditioning engineer for the company. Mr. Price was formerly vice-president and sales manager of the Hardinge Fuel Oil Heating Company, until the sales and installation of Hardinge burners were taken over by the factory. He is active in Chicago heating circles, being chairman of the Standardization Committee of the Chicago Oil Burner Association.

**L. J. Wing Mfg. Co.,** New York, has appointed the Sheffler-Gross Co., Inc., 205-211 Drexel Building, Philadelphia, as its Philadelphia representatives for the Wing line of forced-draft blowers, both motor-driven and turbine-driven, as well as Wing unit heaters of the suspended type.

**Oil City Boiler Works,** Oil City, Pa., announces the election of the following officers and directors: President, Frank O'Day; vice-president and general manager, William H. Heagerty; secretary and treasurer, F. M. Baldwin. Directors: E. C. Breen, president First National Bank; Frederick Fair, president Oil City Trust Company; Frank O'Day, William Heagerty and Daniel O'Day, all of Oil City, and L. C. Frohrieb, president Federal Engineering Company, Pittsburgh, Pa., and Van A. Reed, Jr., Pittsburgh, Pa.

**Burnham Boiler Corporation,** Irvington, N. Y., is building a show room, office and warehouse at 222d St., Queens, L. I. On and after March 1 the company's Jamaica office will be transferred to the new quarters. The new warehouse will relieve the congestion at the company's Irvington plant and is designed to afford the New York customers quicker and better service. Lawrence P. Eckfeldt is manager of the Long Island branch.

**Newport Boiler Co.,** Chicago, Ill., announces the appointment of Mr. Hedley to its sales organization to handle all sales in the Buffalo territory.

**Fulton Sylphon Co.,** Knoxville, Tenn., is the new name of the Fulton Company. This change of name, it is stated, has no special significance other than representing a recapitalization of the company in line with its expansion and growth. An increase has been made in the capital stock to take care of plans for expansion of the company's physical properties. The officers continue the same with W. M. Fulton as president; Warren Webster, vice president, and C. N. Mynderse, general manager. There is to be no change in the sales policy of the company.

**Pacific Steel Boiler Corp.,** Waukegan, Ill., has appointed George Bortle and Preston Layton as new additions to its sales staff. Mr. Bortle was formerly connected with the American Insulation Company and Mr. Layton with Pierce, Butler & Pierce Manufacturing Corporation, in the Philadelphia branch.

**American Radiator Co.,** Chicago, Ill., advises that R. B. Flershem, vice-president and general manager of sales, with headquarters in Buffalo, N. Y., has been appointed chairman of the annual joint charities and community fund campaign which will be conducted in Buffalo next May.

**Grinnell Co.,** Providence, R. I., report that John R. Alpine, assistant to the president of the company, with offices in New York City, has been elected a member of the board of directors of the Heating and Piping Contractors New York City Association.

**Nash Engineering Co.,** South Norwalk, Conn., has appointed Charles C. Hunt assistant to the New York City manager. Mr. Hunt was previously connected with Elevator Supplies, Brooklyn, N. Y.

**American Radiator Co.,** Chicago, Ill., announces that Donald M. Forgan, former manager of the St. Louis, Mo., branch, has been appointed assistant to C. M. Woolley, president of the company. Francis Rickley, who was formerly assistant to Mr. Forgan, has been made manager of the St. Louis branch.

**Yeomans Bros.,** Chicago, have appointed Purdy & Henderson, Havana 55, Esquina a Empedrado, Havana, Cuba, as sales representatives for that territory.

**Universal Pipe & Radiator Co.,** New York, which is the parent company of a complete group of industries, owning and operating foundries, blast furnaces, mines, coke ovens and its own iron fields, will move, with its affiliated companies, from its present quarters in New York to the Graybar Building, adjoining the Grand Central Terminal, when this building is completed in April. The other companies involved in this transfer consist of The Central Foundry Company, Central Iron & Coal Company, Central Radiator Company, Central Foundry Company (a New Jersey corporation), Molby Boiler Company, and Essex Foundry.

## Business Changes

**Johns-Manville, Inc.,** New York, has changed its name to Johns-Manville Corporation, with the same address as previously, 292 Madison Ave., New York City.

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**POSITION WANTED**—By mechanical engineer, 29, specializing in heating, ventilating, plumbing, and power plants, as designer, supervisor or estimator. College graduate. Six years' experience. Address Box 27, care of Heating and Ventilating Magazine.

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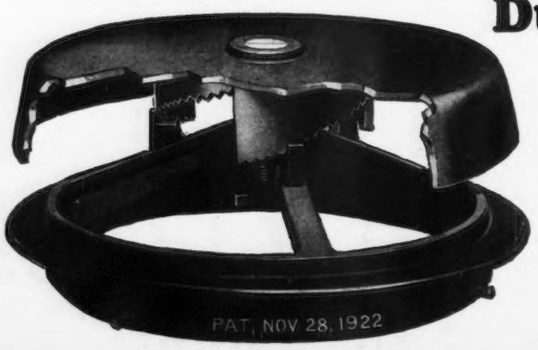


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